

The Pennsylvania State University
The Graduate School

**STAKEHOLDER ENGAGEMENT IN ALL-TERRAIN
VEHICLE RECREATION PLANNING AND
IMPLEMENTATION IN NORTHCENTRAL PENNSYLVANIA**

A Thesis in
Forest Resources and International Agriculture and Development
by
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Abstract

Stakeholder engagement is growing in popularity in environmental decision-making due to public distrust and the growing knowledge and interest of citizens in environmental decisions. Participation in environmental decision-making is increasingly considered a democratic right, especially when public lands are involved. As more people look to the outdoors for recreation purposes, managers need to balance the long-term impacts with the benefits of outdoor recreation. All-terrain vehicle (ATV) recreation is a controversial topic in land management, evoking strong opinions from stakeholder groups. ATV recreation can have impacts on health and safety, other recreation groups, the environment, the quality of roads, management and enforcement capacity, and more. Additionally, ATV planning across the landscape level requires cooperation in planning from multiple jurisdictions and agencies. For these reasons, it is critical to involve stakeholders from a broad range of groups in planning ATV recreation to produce higher-quality decisions, build trust, and foster public acceptance.

In Pennsylvania, the expansion of ATV recreation development on state forests has faced obstacles in policy and enforcement. The state agency responsible for managing state forests, the Department of Conservation and Natural Resources (DCNR), had a longstanding moratorium on ATV expansion in state forests from 2001 to 2020. All of this changed in December 2020, when the Pennsylvania General Assembly mandated the formation of a three-year “ATV Pilot” in the rural northcentral region of Pennsylvania. The purpose of the ATV Pilot was to provide long-distance riding opportunities and bring economic opportunities to the surrounding rural communities. In addition, DCNR was tasked to provide a monitoring study at the end of the three-year pilot in December 2023. To balance the legal requirements of the legislative mandate with DCNR’s principles of ecosystem management and dispersed low-density recreation, DCNR fulfilled the mandate by establishing connectors amongst preexisting ATV trails. While DCNR was the sole authority tasked with the project, the ATV Pilot’s planning and implementation required cooperation from multiple agencies across varying levels of government. The ATV Pilot was officially established as an ATV Connector in January 2024. Its future success depends on the continued monitoring, as well as the acceptance and cooperation of a wide range of stakeholder groups: ATV riders, other recreation groups, residents, business owners, and environmental groups.

This study documents the history of ATV usage on DCNR state forestland, the changes leading up to the 2020 legislative mandate, and the process that DCNR managers undertook to plan and implement the ATV Pilot. The principles of stakeholder engagement are discussed in a literature review and a framework is selected to assess stakeholder involvement in the ATV Pilot. A stakeholder engagement assessment was conducted using data from interviews and recommendations are provided for future planning opportunities. The stakeholder engagement assessment critiqued how DCNR engaged with stakeholders, how stakeholder feedback influenced the ATV pilot, and whether stakeholders were satisfied with the outcomes.

Appendix I features additional work that was carried out to assess the economic impact of the ATV Pilot. Appendix II contains a case study discussion of the Water-Energy-Food-Ecosystem Nexus in the Umgeni Catchment of KwaZulu-Natal, South Africa—a study that was conducted to fulfill a dual degree in International Agriculture and Development.

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List of Abbreviations

ANF	Allegheny National Forest
ATV	All-Terrain Vehicle
BOF	Bureau of Forestry
CNRAC	Conservation and Natural Resources Advisory Council
DCNR	Department of Conservation and Natural Resources
DFFE	Department of Forestry, Fisheries, and the Environment - South Africa
EMAC	Ecosystem Management Advisory Committee
EMS	Emergency Medical Services
FC	Fiscal Code
FIFA	International Federation of Association Football
GDP	Gross Domestic Product
GIS	Geographic Information System
IAP	Invasive Alien Plants
INTAD	International Agriculture and Development
KZN	KwaZulu-Natal
PA	Pennsylvania
PEDF	Pennsylvania Environmental Defense Foundation
PGC	Pennsylvania Game Commission
RHP	River Health Program, South Africa
SAAC	Snowmobile and ATV Advisory Committee
SH	Stakeholder

STEER	Institute for Environmental Systems Research
TAC	Trails Advisory Committee
URC	Upland River Conservation
USD	United States Dollars
UTV	Utility Task Vehicles
WEFE	Water-Energy-Food-Ecosystem Nexus
WWF	World Wildlife Fund

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“Recreational development is a job not of building roads into lovely country, but of building receptivity into the still unlovely human mind.”

*Aldo Leopold
The Upshot: Conservation Esthetic*

Chapter 1. ATV Recreation in Pennsylvania State Forestland

Stakeholder engagement is growing in popularity in environmental decision-making due to public distrust and the growing knowledge and interest of citizens in environmental decisions. Participation in environmental decision-making is increasingly considered a democratic right, especially when public lands are involved (Reed, 2008). As more people look to the outdoors for recreation purposes, it is important to balance the long-term impacts and costs with the benefits of outdoor recreation. All-terrain vehicle (ATV) recreation is a controversial topic in land management, evoking strong opinions from stakeholders. While ATV recreation is often touted for bringing economic benefits to local rural communities (Appendix I), ATV recreation can have hidden impacts and costs on health and safety, other recreation groups, the environment, the quality of roads, management and enforcement capacity, and more (Neupane et al., 2024). Additionally, ATV planning across the landscape level requires cooperation in planning from multiple jurisdictions and agencies. For this reason, it is critical to involve stakeholders from a broad range of groups in planning ATV recreation.

To provide the necessary context for the ATV Pilot, this chapter documents the history of ATVs in Pennsylvania state forestland, the changes leading up to the legislative mandate—represented by a timeline in Figure 1—and the process that Pennsylvania’s state agency, the Department of Conservation and Natural Resources (DCNR) undertook to plan and implement the ATV Pilot. This was compiled through a study of policy, DCNR and their Bureau of Forestry (BOF) management plans, contracted feasibility studies and surveys, informational webinars, DCNR’s General Assembly Report on the ATV Pilot, and DCNR press releases. These findings were supplemented with information from the DCNR manager interviews that were conducted for the stakeholder assessment.

I. Pennsylvania’s Department of Conservation and Natural Resources

Pennsylvania’s state agency, the Department of Conservation and Natural Resources (DCNR) was restructured from the Department of Environmental Resources in 1995 and manages the state parks and state forests. Currently, DCNR manages and maintains 124 state parks and 2.2 million acres of state forest. DCNR is headed by the secretary, who is appointed by the governor. All other positions under the secretary are appointed through competitive hiring. Serving directly under the secretary are several deputy secretaries (DCNR, 2024). Leading DCNR’s Bureau of Forestry (BOF) is the State Forester. For this study, the secretary, deputy secretaries, and State Forester are referred to as “senior management.”

During the time of the ATV Pilot, regional foresters and then district foresters worked under the State Forester. In addition, there were program chiefs, heading various programs including, recreation. One of DCNR’s responsibilities is managing the state’s ATV recreation programs (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

II. Introduction to ATVs in State Forests

DCNR’s Bureau of Forestry (BOF) manages 2.2 million acres of state forest in Pennsylvania for ecosystems and biodiversity while providing opportunities for ecosystem services, low-

density recreation, and sustainable use of timber and minerals (DCNR, DCNR Bureau of Forestry, 2024). Shortly after emerging on the market in the 1980s, ATVs began using existing snowmobile trails in the state forests. State forest managers noted that ATVs were causing damage to the trails and forest and took measures to control activity, such as putting up gates and signs. In 1985, the Snowmobile and ATV law was amended by the Pennsylvania General Assembly to require the state forests to set aside designated trails for ATVs, as well as title and register ATVs (Assembly, Title 75, 1991; Davey, Siefert, & Merrill, 2021; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

III. Moratorium Period

In 2000, a report from the DCNR Office of Policy assessed the impacts of ATV usage in state forests by surveying all district foresters. The study revealed that the most significant problems were riders going off the trail and erosion. There were 2,535 miles of illegal trails reported by the district foresters—over 10 times the length of the 222 miles of legal trails. Districts faced challenges enforcing illegal usage. The study recommendations were increased enforcement staffing and authority, elimination of illegal trails, and educating the laws through ATV dealers (Tropea, 2000; Davey, Siefert, & Merrill, 2021; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

The results of this study led to a DCNR policy establishing a moratorium on the expansion of ATV trails in state forests in 2001 (DCNR, ATV Trail Development and Management Policy, 2020; Davey, Siefert, & Merrill, 2021; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). While ATV riding was still permitted on the designated trails, the demand for more ATV trails increased over the next 20 years as ATV and Utility Task Vehicles (UTVs) gained in popularity and their owners and other proponents exercised greater political power.

While the moratorium prevented the further expansion of ATV trails in state forests, it did not address the enforcement issues and illegal use of trails. According to former district foresters, Davey et al. (2021), the BOF repeatedly reported on the damage and safety concerns of illegal ATV usage in public policy statements, which were ignored by the political powers and the eventual legislative mandates. As late as 2016, the BOF State Forest Resource Management Plan mentioned the state forest roads are not suitable for connectors between trail systems, due to safety concerns. The BOF remained in support of their existing policy against trail expansion because it balanced the needs of ATV riders with other state forest uses and focused on “dispersed, low-density, outdoor recreation” (DCNR, State Forest Resource Management Plan, 2016). Their focus was on maintaining the existing trails and preventing illegal trail riding through enforcement, outreach, and education. These existing trails consisted of 273 miles of trails on 11 trail systems in 7 state forests (DCNR, State Forest Resource Management Plan, 2016; Larson Design Group, 2018). The growing demand for ATV trails was met through public-private partnerships off DCNR lands or on lands acquired specifically for ATV trail development, such as degraded mine land. Over \$12 million was invested in ATV-related grants (DCNR, State Forest Resource Management Plan, 2016; Pashek MTR, 2019).

IV. Changes Brewing

A growing desire for change was expressed in grassroots efforts by ATV clubs; local, county, and state advocacy for ATV riding; and surveys of ATV riders. These, along with growing political pressure, resulted in feasibility studies, changes in recreation planning, and eventually a revision of DCNR policy.

Around 2014, a county commissioner collaborated with a regional ATV club to brainstorm the “Northcentral ATV Initiative.” This initiative, along with grassroots advocacy, urged local governments to open their roads to ATV riding. This initiative also called for state forest roads to be open to ATV riding. However, at the time, state forest roads were closed for ATV riding due to the moratorium. The Northcentral ATV Initiative made DCNR aware of the growing need for more ATV riding opportunities and led to an ongoing exchange between the ATV clubs, government, DCNR, and the state Department of Transportation (“PennDOT”) (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

A 2017 study by Lord & Elmendorf provided updated data on ATV rider’s needs. The study reported that ATV riding is a maturing sport, with the number of registered ATVs in PA declining by 2.7% since 2003. The study also reported that ATV riders sought more involved opportunities, such as more challenging trails and multi-day riding experiences. The growing popularity of UTVs made the sport more accessible to families and long-distance riders. Lord & Elmendorf’s study also discussed increasing incomes in the ATV rider demographics; however, the income comparison was not adjusted for inflation (Lord & Elmendorf, 2017; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Also in 2017, a statistically valid survey of a random sample of the public revealed their perception of ATV use in state parks and state forests. 12% of participants reported there should be more ATV riding opportunities and only 4% reported using state forest lands for ATVs or motocross. Of the comments referencing ATVs, 81% were opposed to their use in the state forest (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

That same year, DCNR’s Conservation and Natural Resources Advisory Council (CNRAC) reviewed the growing demand for more ATV riding opportunities. The council established a working group that completed a report in 2019. Their report highlighted challenges in DNCR infrastructure that would inhibit establishing an ATV connector system. The report recommended possibly adapting the moratorium policy to consider legal riding opportunities on state forest roads; updating fees to leverage funding; and building partnerships with economic developers. The report recommended a stakeholder management structure that works with DCNR to include local and county government, federal partners, PennDOT and other state agencies, private landowners, land conservancies, tourism organizations, utility and oil/gas/mining interests, ATV clubs, DCNR Snowmobile ATV Advisory Committee, law enforcement, DCNR internal bureaus (Kribbs, 2019). There were no recommendations for dealing with illegal use and the associated environmental concerns, and there was no mention of including stakeholders from nonmotorized recreation or a broader array of environmental and conservation groups.

In 2018, Larson Design Group published a feasibility study on connecting two established state forest ATV trails, Whiskey Springs and Bloody Skillet, to address the growing popularity of ATV and UTV riding. The study claimed that poor riding experiences result in illegal ATV riding and that providing more riding opportunities to meet the needs of ATV riders would help prevent this. As part of the feasibility study, Larson Design Group met with stakeholders and reported on their feedback. The list of environmental concerns was far lengthier than any of the other feedback in support or against the connector. The study proposed a trail that would be 27 miles through state forest, including 19 miles of new trails, for \$20.7 million. The high costs resulted from jurisdictional challenges, such as the need for PennDOT approval on state roads closed to ATV riding, as well as numerous environmental concerns, such as stream crossings. Just before this study was completed, the Pennsylvania General Assembly passed a 2018 Fiscal Code amendment. This amendment called for DCNR to consult with PennDOT to develop the using existing state roads and state forest roads—challenging the previous constraints and rendering the Larson proposal unnecessary (Larson Design Group, 2018; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). The 2018 fiscal mandate was unable to be completed because of high costs, safety concerns, existing policies, enforcement concerns, adjacent landowner concerns, staffing capacity, conflicting recreation concerns, and EMS concerns (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). The Larson study along with the 2018 legislative mandate shows the determination, backed by state and county political powers, to make a connection between these two trail systems.

In search of additional ATV riding opportunities, Pashek MTR published a feasibility study in 2019 that assessed the entire state. This study used GIS to overlay various constraints and found priority areas for ATV trail development, that could be pursued mostly in conjunction with private partners. The study emphasized the importance of having local champions for advocacy and partnerships (Pashek MTR, 2019).

The Larson Design Group and Pashek MTR studies mentioned above were both conducted under the preexisting moratorium on ATV expansion on state forestlands. This was all about to change.

Background history of the ATV Pilot

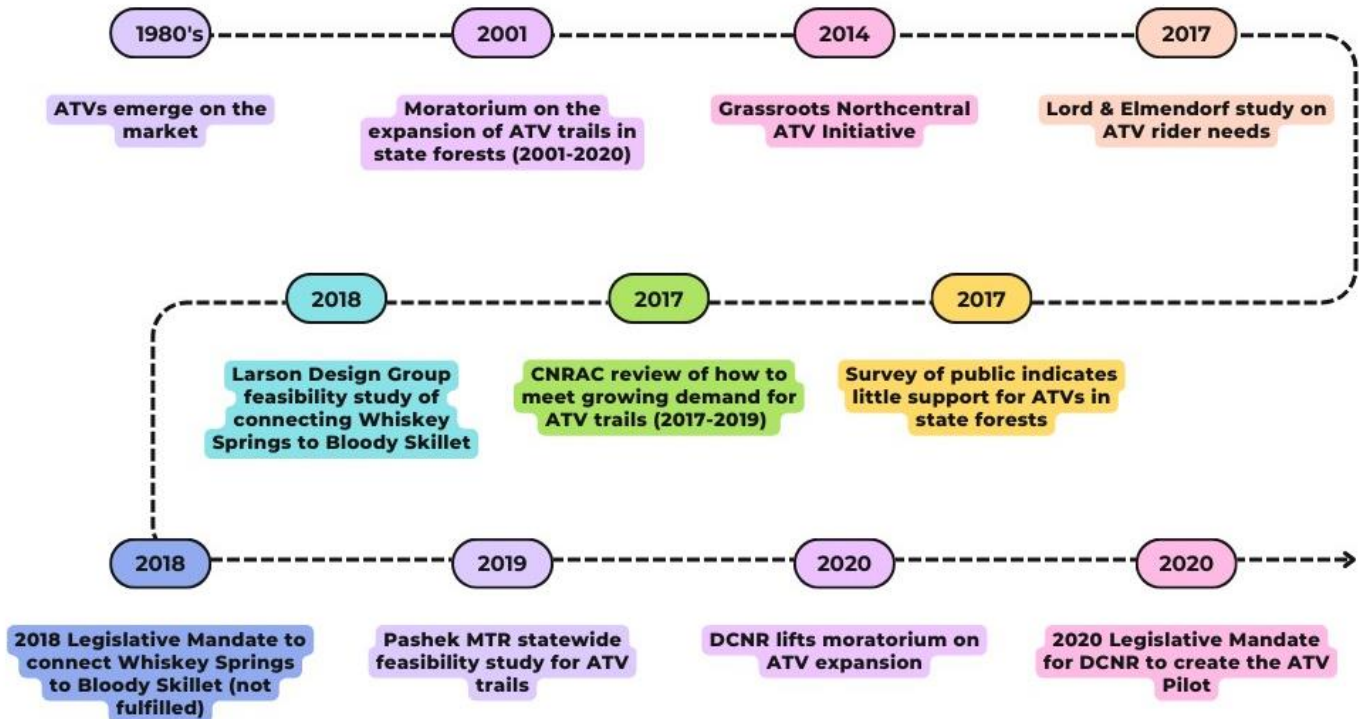


Figure 1: Timeline of the history of ATVs in Pennsylvania state forest and the changes leading up to the ATV Pilot

V. 2020 DCNR Policy Revision and Fiscal Code Amendment

A. DCNR Policy Revision

In 2020, DCNR began a policy revision on the ATV moratorium. It is unclear whether this was the result of the recommendations of the Conservation and Natural Resources Advisory Committee report (2019), political pressure from failure to fulfill the 2018 legislative mandate (Davey, Siefert, & Merrill, 2021), or a proactive effort to mitigate talk in the legislature about opening *all the state forest roads* to ATV riding (DCNR Manager Interview, 2023). This policy revision removed the moratorium on ATV trail development, authorized the expansion of ATV trails and construction of strategic connectors on state forestlands, and allowed the designation of state forest roads for ATV use on a case-by-case basis. However, the policy states that state forest roads are not a viable option for ATV connectors (DCNR, ATV Trail Development and Management Policy, 2020; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). The policy revision was drafted by an internal working group on motorized vehicles. According to one of the DCNR managers, it was distributed for public comment with a press release. Additionally, DCNR hired a motorized recreation specialist and adapted ATV management principles centered around ecosystem management, low-density dispersed recreation, and co-location of ATV riding whenever possible to reduce fragmentation and potential road use (DCNR Manager Interview, 2023).

According to a DCNR manager, there were other legislative bills proposed in 2020 that would expand ATV riding opportunities. This DCNR manager reported that in September 2020, DCNR senior management found out about a proposed bill that would open all of Tioga State Forest roads to ATV use. DCNR senior management reached out and worked with the state legislators to steer it in a direction that was more manageable and compatible with their vision of state forest use—they suggested broadening the scope to the Northcentral region to allow for more flexibility in routing and emphasized the need for monitoring, public report, and stakeholder engagement. These changes were included in the 2020 Fiscal Code amendment and helped create a framework for an ATV Pilot (DCNR Manager Interview, 2023). It is unclear whether DCNR senior management would have had any influence on the six-month timeline for implementing the ATV Pilot or adding other state agencies, such as PennDOT, as legally mandated collaborators. These both became hurdles for DCNR in the ATV Pilot implementation.

Five days after DCNR's policy change, the Fiscal Code legislation mandating the ATV Pilot was passed by the General Assembly (DCNR, ATV Trail Development and Management Policy, 2020; Assembly, Fiscal Code - Omnibus Amendments, 2020 Act 114, 2020).

B. Fiscal Code Amendment

The Fiscal Code was originally passed in 1929. Every year since 2006, the general assembly passes a bill to amend the Fiscal Code, which provides specifications on how to implement the annual budget. This has resulted from a 2006 court decision preventing the budget bill from specifying how the money is spent. The Fiscal Code Amendments are an omnibus of amendments that are first approved by the legislature. They can either be fully passed or fully vetoed by the governor. However, the state governor is unable to cancel line items on the Fiscal Code (Stakeholder Interview, 2024; Markosek, 2016).

In 2020, the Pennsylvania legislature passed an interim budget in May that only accounted for five months of spending due to the uncertainty of the COVID-19 pandemic. There was growing pressure to come to an agreement and provide COVID-19 relief, and the Fiscal Code Amendments, along with the final budget, were unable to be finalized by the legislature on November 20. The Fiscal Code Amendments were signed by the governor on November 23, 2020 (Blake, 2020; 2020-21 State Budget, 2020).

The 2020 Fiscal Code Amendments, also known as House Bill 2536, featured 47 house items and 24 senate items from a variety of topics including attorney fees in sexual harassment cases, funding to cities that provide supervised safe injection sites, COVID-19 Fire and EMS, senior care, and rental and mortgage assistance. House Bill 2536's primary sponsor was Representative James, from the 64th district in northwestern Pennsylvania. The other sponsors were Representatives Moul, Everett, Freeman, Sappey, and Kortz. Only Representative Everett represented a portion of the ATV Pilot region in Lycoming County (Assembly, Fiscal Code - Omnibus Amendments, 2020 Act 114, 2020). However, it is unclear who drafted the line item detailing the ATV Pilot. According to the DCNR managers and stakeholders interviewed, there were several representatives and senators from the ATV Pilot region supporting the legislation (DCNR Manager Interview, 2023; Stakeholder Interview, 2024), but their names were not documented in the bill.

Voting on the final Fiscal Code Amendments took place on Friday, November 20th. The Senate passed it first with 33 in support and 16 in opposition. The discussion was minimal and focused on funding for education (204th of the General Assembly--Senate, 2020).

The November 20th House session started as an in-person session. They broke out into caucuses from 2-3 pm. The recess was extended five times until finally reconvening at 5:15 pm. At this time, the Speaker announced: “For the information of the members as well as the general public, the remainder of this session has been converted to a virtual session due to continued contact tracing.” The Fiscal Code Amendments were the last bill voted on for the day. The discussion of the amendments was minimal and centered on funding that was taken from various programs. The bill passed in the virtual session, with 108 in support and 92 in opposition. Senator Briggs later expressed his disappointment with the lack of discussion around the bill. He stated, “At the last minute on Friday afternoon, House members were told not to even set foot on the House floor and told to cast our votes remotely, as the rest of the session would be held virtually ... It is disturbing that on an issue as important as the State budget, lawmakers were prevented from debate” (204th of the General Assembly--House of Representatives, 2020).

The ATV Pilot is mandated in section 1720-E of House Bill 2536. Section 1720-E states:

The department [DCNR] shall establish a regional pilot program for ATV use on department lands.

(2) As part of the pilot program, by December 31, 2020, the department shall: (i) evaluate department forest districts, including Elk, Moshannon, Sproul, Susquehannock, and Tioga, for roads and trails to serve as potential regional connectors and to provide local access or serve as a trail complex for ATV use; and (ii) perform an assessment regarding charging fees for access to the department ATV pilot area.

(3) Beginning January 2021, the department shall: (i) consult with local community leaders to assess their interest in and the feasibility of a department ATV pilot area; (ii) perform outreach to affected communities and stakeholders; and (iii) map, mark and designate roads and trails in the department ATV pilot area for use as permitted under this subsection.

(4) Upon completion of the requirements under paragraphs (2) and (3), the department may apply a fee and sell tags for access to the department ATV pilot area using a tag system to designate access.

(5) The department shall provide access to the department ATV pilot area for the 2021 summer ATV riding season from the Friday before Memorial Day through the last full weekend in September, in addition to an extended season to be determined by the department based on local conditions.

(6) In order to access the department ATV pilot area roads or trails, a person with a registration under 75 Pa.C.S. § 7711.1 (relating to registration of snowmobile or ATV) must apply for, obtain and prominently display a department ATV pilot area tag upon the ATV machine.

(7) The fee per tag shall be determined by the department during the pilot program assessment under paragraph (2)(ii). The tags shall be dispersed on a calendar-year basis.

(8) All fees collected under this subsection shall be deposited into the restricted

account as provided for under 75 Pa.C.S. § 7706(a)(1) (relating to restricted accounts) and shall be allocated to the department's ATV Fund which funds ATV activities, enforcement and maintenance on department lands, as provided for in 75 Pa.C.S. § 7706(b).

(9) The department shall monitor the use, enforcement, maintenance needs and any associated impacts to State Forest land resources, value and forest users resulting from the department ATV pilot area. On or before December 31, 2023, and every three years thereafter, the department shall submit a report to the General Assembly on the department ATV pilot area.

(Assembly, Fiscal Code - Omnibus Amendments, 2020 Act 114, 2020)

It is unclear why section 1720-E of the Fiscal Code Amendments specified a short six-month time period for implementing the ATV Pilot or designated DCNR as the sole authority of the project. DCNR managers reported that the timeframe and designation of authority were both problematic in the planning and implementation (DCNR Manager Interview, 2023). The 2018 Fiscal Code Amendment mandating the ATV Connection between Bloody Skillet and Whiskey Springs specified that DCNR works with PennDOT (Assembly, Fiscal Code - Omnibus Amendments, 2020 Act 114, 2020). According to a DCNR Manager, the legislator drafting that section of the Fiscal Code Amendments was relatively new, potentially resulting in the six-month timeframe and designation of DCNR as the sole authority. However, this was not verified by a stakeholder interview with a member of the General Assembly (Stakeholder Interview, 2024; DCNR Manager Interview, 2023).

Without other state agencies formally involved, DCNR had to negotiate between agencies and levels of jurisdiction. After the passing of the Fiscal Code Amendments, the political climate, resulting from the continued tensions between ATV interests and state forests, was described as such: “It was going to happen no matter what. If we did nothing, it could have been a lot worse” (DCNR Manager Interview, 2023).

Some of the DCNR managers who would later become heavily involved did not find out about the legislative mandate for the ATV Pilot until after it was passed in November 2020, which was like a “freight train coming on.” After finding out, some DCNR managers drafted comments on the ATV policy change and legislative mandate to share with the State Forester, expressing concerns about the process behind these changes. Their perception was that programs like this should not be implemented through a legislative mandate. The decision-making process of the legislative mandate for the ATV Pilot was also questioned in a lawsuit from an environmental foundation based on a breach of public trust (DCNR Manager Interview, 2023). This case was dismissed in November 2022 on the basis that the ATV pilot was experimental and provided monitoring to address environmental concerns. Additionally, the lawsuit did not provide circumstantial evidence (Pennsylvania Environmental Defense Foundation v. Commonwealth of Pennsylvania, 2022; Stakeholder Interview, 2024). A new lawsuit was filed by the same foundation in April 2024, providing circumstantial evidence from DCNR’s monitoring report to the General Assembly and individual testimonies. The outcome of this lawsuit has not yet been determined (Petition for review of state actions causing the loss of state forest trust assets, 2024).

VI. Developing the ATV Pilot Connector

Once the legislative mandate for the ATV Pilot was announced, the task was handed to DCNR regional managers, section managers, and district foresters, who will be referred to as “DCNR managers” for the rest of this study. To successfully implement the ATV pilot by the assigned deadline of Memorial Day Weekend of 2021, the project required DCNR managers to collaborate with other government agencies not legislatively mandated, as well as local and county champions. In their planning process, DCNR managers emphasized their commitment to prioritizing the values of the state forest and upholding DCNR’s constitutional responsibility to protect public natural resources (DCNR, ATV Trail Development and Management Policy, 2020; Assembly, Fiscal Code - Omnibus Amendments, 2020 Act 114, 2020; DCNR Manager Interview, 2023).

The focus of the ATV Pilot was on the northcentral region of Pennsylvania because there were several established ATV trail systems: the Susquehannock, Whiskey Springs, Bloody Skillet, and Haneyville ATV trails (Figure 2). The goal was to connect these established systems by relying mainly on existing roads and occasionally snowmobile trails to minimize both the negative impacts on the environment and reduce the cost of establishing new trails. In addition to having four already established ATV trail systems, the northcentral region also had county government supporting ATV recreation. Potter County, where much of the initial ATV pilot was established, has had motorized recreation as part of its regional plan since 2019. Many of the township roads in this region were already open to ATV riding (DCNR Manager Interview, 2023; Stakeholder Interview, 2024; Potter County, Pennsylvania, 2019).

DCNR managers asked the forest districts in the northcentral region to review what they thought was feasible at the district level. Managers created a list of the stakeholders that had the authority to be directly involved in the decision-making. They reached out on an individual basis to build relationships and inform. This initial outreach was centered around groups that were essential to forming the pilot connectors: PennDOT, county officials, local government, local ATV clubs, and the snowmobile association (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023; DCNR Manager Interview, 2023).

DCNR established an internal planning team to look for opportunities and identify problematic areas to avoid. They developed and utilized a Trail Assessment Worksheet. Problem areas included areas where they anticipated potential for conflict with other recreation groups; environmentally sensitive areas; townships unwilling to open their roads to ATVs; and segments of state roads that are unsafe for ATV riding. After the initial planning, DCNR managers consulted with local businesses, PennDOT engineers, township supervisors, and county planners to identify opportunities and problem areas. DCNR managers collaborated with PennDOT and local government to create routes avoiding problematic areas by using state roads or by reinforcing snowmobile trails to establish a connection (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023; DCNR Manager Interview, 2023).

As stated earlier, the legislative mandate gave DCNR six months to establish the ATV Pilot—hardly enough time to plan and implement, let alone properly involve stakeholders. By early May, the DCNR was still waiting for approval on some routes that were outside of their jurisdiction. They got their approval in mid-May but still needed time to set up maps

and signage. The ATV Pilot officially opened on July 17, 2021 (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Due to the constraints established by the legislative mandate—limited time and jurisdictional authority—DCNR did not reach out to other stakeholder groups until late May 2021. The exception is if they were approached first by the stakeholders and several meetings with townships (DCNR Manager Interview, 2023).

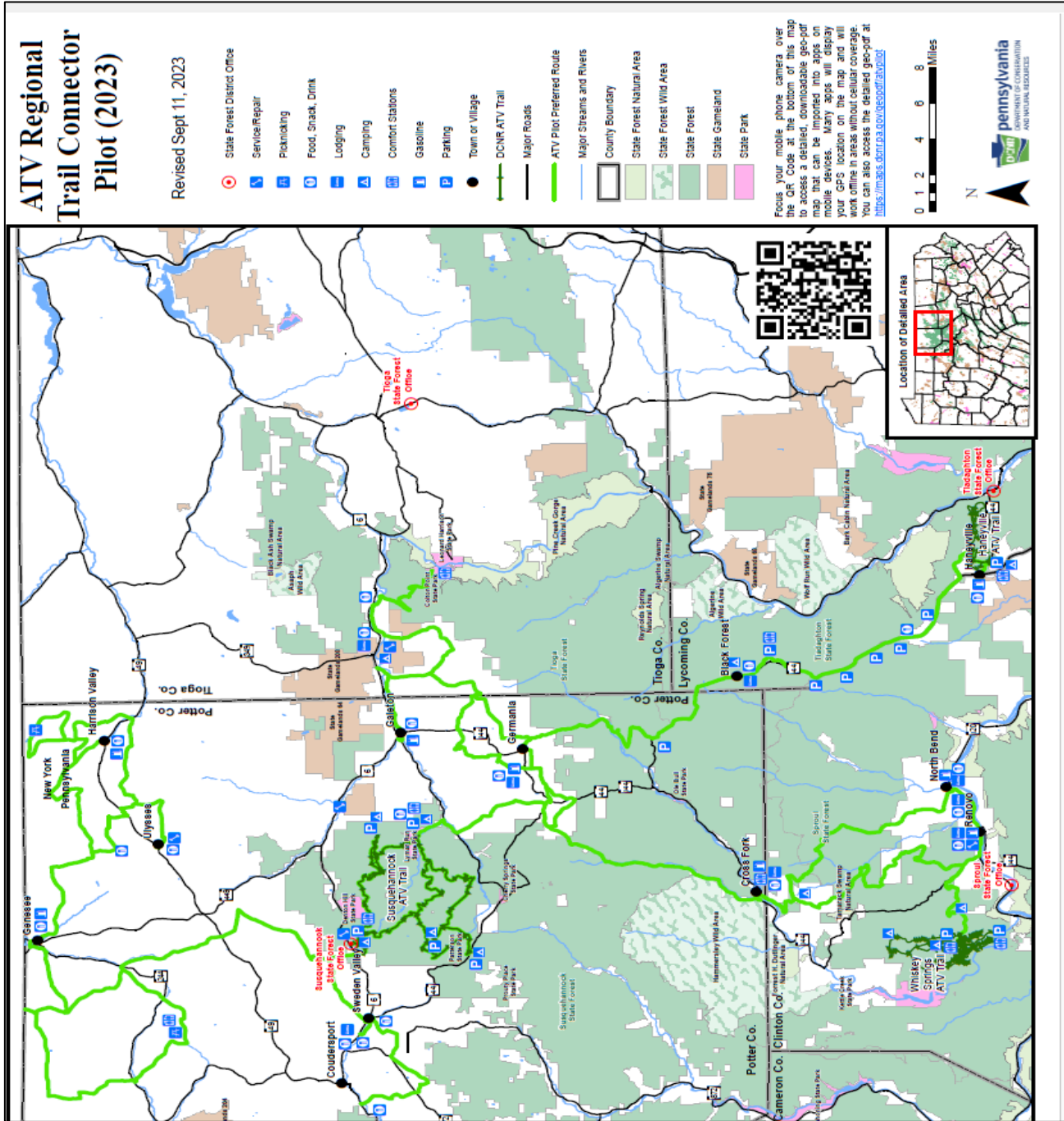


Figure 2: A map of the ATV Regional Trail Connector Pilot. Source: (DCNR, 2024)

In 2021 and subsequent years, DCNR conducted a State Forest Environmental Review to check for illegal trails, establish monitoring indicators and corrective actions, and ensure proper signage. Route approval for the year was conditioned on these terms (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

VII. Opening the trail and engaging stakeholders

By 2023, the ATV Pilot successfully connected the existing Susquehannock, Whiskey Springs, and Haneyville ATV Trails and covered areas of Potter, Tioga, Lycoming, and Clinton Counties (Figure 2). It included the preexisting ATV trails, local township roads, state roads, and a resurfaced snowmobile trail. While it took three years to finalize all of the current connections to the ATV trails, the first year provided enough miles to be in operation on July 17, 2021, and remain open until the last weekend of September. Since then, the ATV Pilot has been in operation from Memorial Day weekend to the last weekend of September 2023. At the end of 2023, the General Assembly voted to move beyond the pilot phase into an established connector (DCNR, DCNR set to open ATV regional trail connector pilot area July 16, 2021; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Once the routing for the first year was complete, the public was notified with a press release on June 28, 2021. The opening of the pilot was also mentioned in the BOF District Forest activity plans, which are posted online for each of the forest districts connected to the ATV Pilot. DCNR also made an email address, which they publicized on their website, for the public to submit comments. Comments were monitored throughout the 3-year pilot period for feedback. There was also an informational webinar, open to the public, at the end of the riding season in 2021 (DCNR, ATV Regional Trail Connector Pilot Informational Webinar, 2021). DCNR managers met with local government personnel, supervisors, maintenance managers, local police, and local first responders, county dispatch to get their feedback on the ATV Pilot at the start and end of the riding seasons. These meetings were also open to the public. DCNR surveyed public opinion at the end of the riding seasons in 2021 and 2022 by posting a link to their website and sharing on social media (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). They also surveyed the local government in 2023 to learn about their satisfaction with the fiscal sustainability of the ATV connector and their willingness to continue participating in the future (DCNR Manager Interview, 2023).

In addition to DCNR's direct outreach with the stakeholder groups listed above and the public, Potter County established an ATV Task Force in June 2021 with representatives from state police, state parks, tourism agencies, recreation groups, first responders, and law enforcement. The task force idea was created by a local champion from the county government to address an information gap—local and county government and residents were hearing rumors about the ATV Pilot ahead of what DCNR was announcing. The task force provided a structure to inform stakeholders and provided feedback to DCNR. The task force remained active until the end of the pilot phase of the project in 2023 (DCNR Manager Interview, 2023; Stakeholder Interview, 2024). Each year, DCNR managers engaged in the process of approaching local government and PennDOT with routing proposals. There was often a back-and-forth negotiation. In specific situations, other stakeholders would provide recommendations on routing—recreation and environmental groups, or residents. Sometimes

DCNR managers would have to draft an entirely new connection between segments when an agreement could not be reached. Permission to open certain connectors sometimes took over a year of review and negotiation. When looking at the map (Figure 2), these constraints and negotiations explain some of the lengthy or, at times, nonintuitive, routes to get from “Point A to Point B” (DCNR Manager Interview, 2023). For example, Colton Point State Park, which includes a vista overlooking the Pennsylvania Grand Canyon, can only be accessed via a lengthy route. This was done to minimize the impact of noise and dust on this popular tourism destination. Another example is the portion north of Route 6, which can only be accessed by one crossing over the highway near Sweden Valley. This is because of safety concerns—Route 6 is a busy highway with lots of traffic and PennDOT would only approve crossings at 90 degrees with adequate visibility (DCNR Manager Interview, 2023; Stakeholder Interview, 2024).

VIII. Monitoring Project

The legislative mandate required monitoring and reporting at the end of the 3-year pilot in 2023. The language and terms relating to monitoring were put in place at the request of DCNR senior management to evaluate the social, economic, and environmental sustainability of the ATV Pilot (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). The monitoring project provided opportunities for DCNR to report to stakeholders and the General Assembly on the degree of success of the ATV pilot.

The environmental monitoring was conducted internally by DCNR’s experts and tracked illegal trails, sensitive trails, sensitive habitats, and invasive plants. This was only conducted on state forest lands because the DCNR does not have jurisdiction over private lands. The monitoring team contracted with Penn State University for portions of the social and economic studies, which partially supported the present study. Social monitoring included the public’s perception (via their public survey and comment logs), visitation counts, impacts of sound on hikers, a survey of residents, and records of law enforcement and safety incidents. The economic study estimated the positive economic impacts on the local communities (Appendix), collected feedback from local businesses, and tracked the costs and revenue of DCNR including funds disbursed to the local government for road maintenance and dust (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Stakeholders were involved in providing feedback on specific items to monitor. The monitoring project utilized the advisory committees to inform stakeholders about the results. These advisory committees included: the Ecosystem Management Advisory Committee (EMAC), Conservation of Natural Resources Advisory Committee (CNRAC), and Snowmobile ATV Advisory Committee (SAAC). The monitoring results were also reported to municipalities, county planners, state police, local police, local first responders, tourism agencies, and recreation groups (DCNR Manager Interview, 2023).

DCNR Managers report that they prefer to have more time to convene with experts and decide how to do the monitoring. For example, when updating their forest inventory protocol, they had three years to work with external committees and experts. They did not implement the new protocol until they were ready. In this case, due to the terms outlined in the legislative mandate, the ATV Pilot had to be implemented largely before the monitoring

process was set up. The monitoring of the ATV Connector will continue and will adapt to changes or new concerns (DCNR Manager Interview, 2023).

IX. Beyond the ATV Pilot: Transition to Regional Authority

The future of the ATV Connector will involve a two-year period (2024-2025) of transition towards a regional authority, with each authority retaining its sovereignty, rules, and policies. This regional authority was recommended in response to the managerial challenges faced by DCNR managers. DCNR's recommendations for the regional authority are outlined in their General Assembly report and include stakeholder engagement and improved collaboration with an advisory board of stakeholders; sustainable staffing and funding with its own legal structure; routing requests that are submitted to the appropriate jurisdiction to establish agreements (where the authority retains their ultimate power of approval or denial); capacity control; support for maintenance, law, EMS, planning; and outreach and tourism. (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023; DCNR Manager Interview, 2023).

Chapter 2: Literature Review on Stakeholder Engagement

As stated in Chapter 1, stakeholder engagement was a critical component in DCNR's planning of the ATV Pilot and was necessary to produce higher-quality decisions, build trust, and foster public acceptance. Additionally, since the ATV Pilot was a controversial topic, stakeholder engagement could alleviate adversarial relationships and build a mutual understanding (Reed, 2008). Below is a review of stakeholder engagement within the context of environmental decision-making. The review identifies the types of stakeholder participation, the benefits and costs of stakeholder participation, and the keys to a successful stakeholder engagement process.

Stakeholders are groups or individuals who are impacted by a decision-making process or have an interest in an activity related to the decision-making process (Reed, 2008). Common stakeholders that are often involved in an environmental management context include regulators, the press, different user groups, communities surrounding the area, consumers of a resource, and the public (Mease et al., 2018).

Stakeholder participation can take many forms and has been categorized by the degree of involvement, the method of involvement, the theoretical basis for involvement, or the objectives for involvement (Reed, 2008). The degree of involvement can range from passive, such as providing information about a project, to active engagement, where the stakeholders have control over decisions (Reed, 2008). Methods of involvement include formal and traditional methods, such as referenda, public hearings, surveys, and focus groups (Rowe & Frewer, 2000), as well as informal methods, such as social gatherings or events with speakers (Holifield & Williams, 2018). A theoretical basis for involvement can range from promoting democratic decisions to creating higher-quality decisions (Reed, 2008; Krupa et al., 2019). Other times, objectives for stakeholder involvement can be as simple as participation as part of an already established policy or process.

The benefits of stakeholder participation in environmental management are that they can bring valuable knowledge and perspectives to the project, build trust, promote equity, legitimize decisions, and limit conflict (Fiorino, 1990; Krupa et al., 2019). The stakeholders themselves can benefit by learning, having a voice, exercising democratic rights, and achieving an improved outcome. As a result, stakeholder participation has become a common and widely accepted component of environmental projects and decisions (Holifield & Williams, 2018).

However, simply having stakeholder participation does not ensure success. Institutionalizing stakeholder participation can ensure it is practiced, but it must be done with clear goals and a shift in organizational structure. Stakeholder involvement for the sake of formality, without any clear goal, or taking place after a decision has already been made can result in a loss of trust (Reed, 2008). Also, institutionalizing stakeholder involvement without addressing equity can result in strengthening privileges and inhibiting marginalized opinions (Krupa et al., 2019). Quality of participation should be prioritized over quantity. Having too many stakeholder engagement opportunities without well-run processes or little reward or influence can lead to stakeholder fatigue (Reed, 2008).

Certain types of stakeholder participation can create bias. For example, public hearings can attract a larger representation of those with education, time, and money—those who know how to navigate bureaucracy (Krupa et al., 2019). Additionally, those with the loudest voices or most power can have more influence (Mease et al., 2018). Public hearings can also polarize opinions and increase conflict (Krupa et al., 2019; Fiorino, 1990). Therefore, careful thought should be put into structure, such as transparency, ground rules, and facilitation for stakeholder participation.

Successful stakeholder engagement is influenced by the way group dynamics are handled by a facilitator, communication with participants, clarity of goals, and quality of planning (Reed, 2008). There are various ways to measure the success of a stakeholder involvement process which are discussed below:

Fiorino (1990) identifies democratic process criteria, based on participation theory, for assessing stakeholder involvement: direct participation of citizens as amateurs rather than in their professional roles, shared authority in governing, dialogue to find shared values and transform conflict constructively, and an underlying basis of equality where citizens are allowed to define issues and shape the agenda (Fiorino 1990). The democratic process criteria are useful for comparing different stakeholder participation methods. However, these criteria alone are not beneficial for this analysis of stakeholder engagement in the ATV Pilot because it focuses on each individual type of stakeholder participation rather than the entire planning process.

Rowe & Frewer (2000) evaluate the outcomes of stakeholder participation based on acceptance and process criteria. Their acceptance criteria for stakeholder participation are representativeness, independent and unbiased management of the stakeholder participation process, early involvement, genuine influence on the decision, and transparency of the decision-making process. Their process criteria are resource accessibility, task definition, structured decision-making, and cost-effectiveness. These criteria are useful for evaluating stakeholder participation and their process is refined by Luyet et al. (2012).

Reed (2008) identifies eight best practices for stakeholder participation. These best practices emphasize empowerment, early involvement, representation, clear and agreed-upon objectives, context-relevant methods, highly skilled facilitation, and integration of local and scientific knowledge (Reed, 2008). These best practices provide enough space for flexibility based on context and they challenge a traditional top-down approach by empowering stakeholders and integrating local knowledge. However, they are broad, and it is difficult to measure the degree to which they are adequately addressed in DCNR's stakeholder involvement.

Mease et al. (2018) discuss guidelines for stakeholder participation: early involvement, inclusion, long-term planning and goal setting, humanizing managers, and transparency. Strategies for involving stakeholders should be adapted to fit changing needs. Their analysis provides a framework for managing stakeholders under various constraints but is not fit for this study because it does not address the varying degrees of involvement under one process. Additionally, it lacks a framework for evaluating stakeholder participation.

Krupa et al. (2020) assess stakeholder participation based on equity, efficiency, and effectiveness. They recommend using qualitative and quantitative methods to measure

relevant demographic data and access to data. Their recommendations toward efficiency and effectiveness are specific to their particular study but emphasize reducing redundant processes, addressing deeper democratic issues in the process, and providing transparency and accountability in the decision-making process.

Luyet et al. (2012) review the literature on stakeholder engagement and propose a framework for an effective process of involving stakeholders. This process involves the stages of stakeholder identification, stakeholder characterization, stakeholder structuring and degree of involvement, choice of participatory techniques, implementation of participatory techniques, and evaluation of stakeholder participation. This study uses Luyet et al.s' (2012) proposed framework to break down and assess each stage of the stakeholder engagement process and help identify areas for improvement in future planning.

Chapter 3. Methodology

I. Stakeholder Engagement Framework

During the literature review, stakeholder engagement best practices were reviewed in the context of environmental management decisions ((Fiorino, 1990; Holifield & Williams, 2018; Krupa et al., 2019; Luyet et al., 2012; Mease et al., 2018; Reed, 2008; Rowe & Frewer, 2000). From this review, the framework by Luyet et al. (2012) was selected because it assesses elements of stakeholder engagement from all stages of the process. Their framework is also useful for environmental management because it applies the principles of adaptive management to stakeholder engagement—a key component of environmental and land-use management. The methods of assessing stakeholder engagement are flexible and can be qualitative or quantitative, depending on the resources and the situation. Luyet et. al.s' (2012) stakeholder engagement framework features inputs—constraints such as policy, timeframe, and cost—and outputs—decisions in planning and implementation. The steps in the framework are presented in a cycle and can be adapted after the final evaluation stage. These steps include stakeholder identification, characterization, structure and degree of involvement, choice of participatory techniques, implementation, and evaluation (Figure 3).

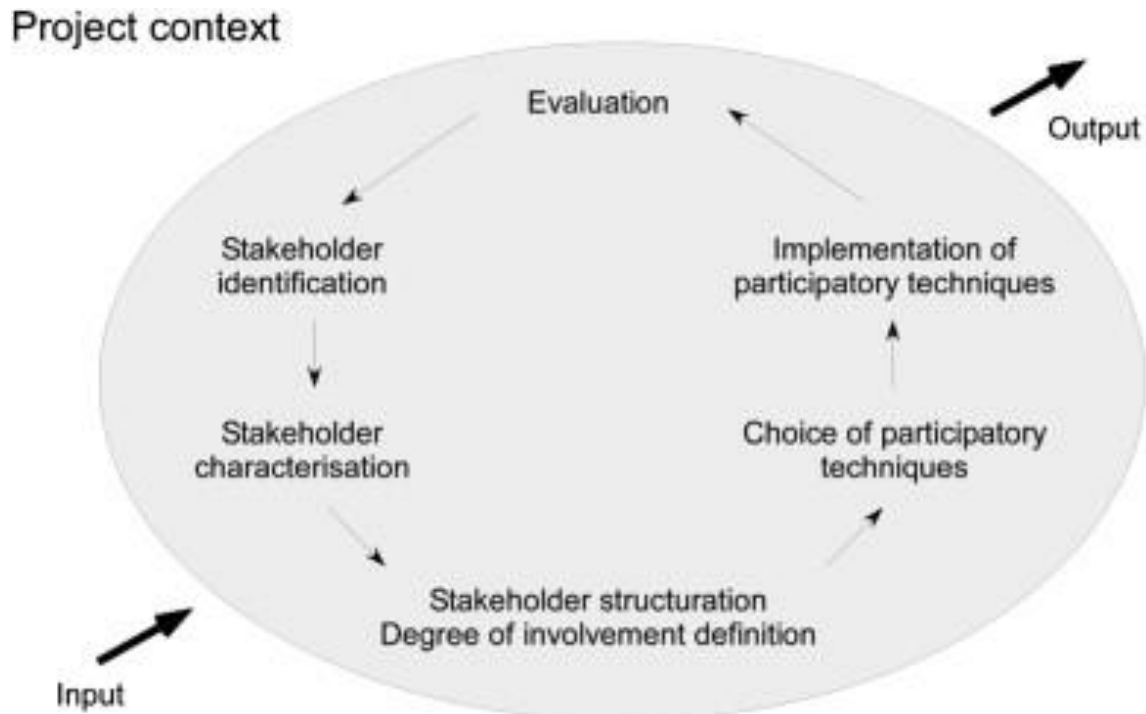


Figure 3: Framework for stakeholder participation. Source: (Luyet, Schlaepfer, Parlange, & Buttler, 2012)

II. Study Procedures

Table 1 shows the number of interviews conducted for this study categorized by type of group. Twenty-seven interviews were conducted for this study. Five were with DCNR managers involved in the ATV Pilot planning and implementation. These DCNR managers listed a total of forty-one stakeholder groups that were involved in their planning and/or implementation process. Snowball sampling was used to identify additional stakeholder groups. Twenty-two stakeholders with representatives from a variety of groups agreed to participate in this study (Table 1). Data from sixteen business interviews conducted to supplement the economic impact study (Appendix 1) for DCNR’s monitoring report to the general assembly were also used, when relevant (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Table 1: Number of interviews conducted for this study, categorized by stakeholder type. Sources: (DCNR Manager Interview, 2023; Stakeholder Interview, 2024; Local Business Interview, 2023)

Type	Organization	Number of Interviews
State Government	DCNR Managers	5
	State Legislature	1
	PennDOT	2
County Government	County Planning or GIS	3
	Community Development	1
	911 Dispatch	1
Local Government	Township supervisor	1
	Township staff	1
Private	Private Partner	1
	Local businesses*	(16*)
NGO	Tourism	1
	Motorized Groups	1
	Environmental groups	3
	Nonmotorized Recreation Groups	3
Individuals	Seasonal Resident	1
	Local experts	2
Total		27
<i>*Local business interviews were conducted as part of a separate economic impact study (See Appendix I).</i>		

The five DCNR managers were selected based on their involvement with the ATV Pilot planning, implementation, and monitoring. The interviews were held via Zoom and were semi-structured with questions structured around understanding the planning and implementation of the ATV pilot, where and when stakeholders were involved, which stakeholders were involved, and what changes were made to the ATV Pilot due to stakeholder feedback. Data from these indicators was used with Luyet et al.s’ (2012) framework to assess DCNR’s involvement of stakeholders.

Representatives from stakeholder groups were contacted for interviews via email invitation. Their interviews were conducted via Zoom and were semi-structured with questions

structured around understanding when and how stakeholders found out about the ATV Pilot, their perceptions of what the ATV Pilot was, how they participated, what feedback they gave, and whether they felt this feedback was adequately addressed. Data from these indicators was used with Luyet et al.s' (2012) framework to assess the effectiveness of their involvement.

For the stakeholder assessment, data for each stage of the stakeholder engagement process was compiled and analyzed to identify trends within and between types of groups and types of participation. The results are qualitative rather than quantitative due to the small sample sizes within each stakeholder group but still serve to identify trends and provide recommendations.

Chapter 4. Results

Based on the interviews and other primary data collected for this analysis, as described in Chapter 3, above, the results of the stakeholder engagement assessment are reported here in the context of Luyet et al.s' framework (2012).

I. Stakeholder Identification

Stakeholder identification assesses *how* stakeholders are identified for their involvement. Failure to identify groups may create bias and lead to negative impacts later in the project. However, identifying too many stakeholders is costly in time and money. Therefore, it is important to have a balance between stakeholder representation and the available resources of time and money (Luyet et al., 2012).

DCNR managers listed a total of 41 stakeholder groups that were involved in their planning and implementation process. Of these, 15 were in government, 5 were umbrella groups, 3 types of residents, 3 motorized recreation groups, 3 environmental groups, 8 non-ATV recreation groups, 2 tourism agencies, and 2 types of private interests. Due to the use of umbrella groups, some of these are double-counted if they were represented in an umbrella group and as an individual group (for example, an advisory committee can include stakeholders from government and recreation) (DCNR Manager Interview, 2023).

When asked if there are any stakeholder groups not involved that should have been involved, stakeholders identified an additional 9 groups not mentioned by DCNR: 1 type of local expert, 7 environmental groups, and 1 non-motorized recreation group. Three stakeholders from these groups responded to the invitation to participate in this study: 2 local experts were interviewed, and one environmental group declined because the ATV Pilot was outside their organization's scope of interest. The two local experts confirmed they were involved in some capacity—such as attending a meeting or completing a survey, but they were not specifically invited by DCNR to provide feedback (Stakeholder Interview, 2024). This brings into question who *should* be involved and at what level. DCNR may have considered these groups but needed to balance the number of groups involved with other constraints. It is important to be clear about who is being involved at what level and why so that stakeholders understand the constraints.

Stakeholder groups that were identified in the interviews included state, county, and local levels of government; government-sponsored umbrella organizations; tourism agencies; private partners and interests; environmental groups; motorized recreation groups; nonmotorized recreation groups; and any other constituents represented by these groups (Figure 4).

During the initial planning phase, stakeholders were identified based on whether their participation was deemed essential to the formation of the ATV pilot to logistically make it work in the 6-month timeframe. The identification process that DCNR managers used was based on their key constraint of only having 6 months to plan the ATV Pilot.

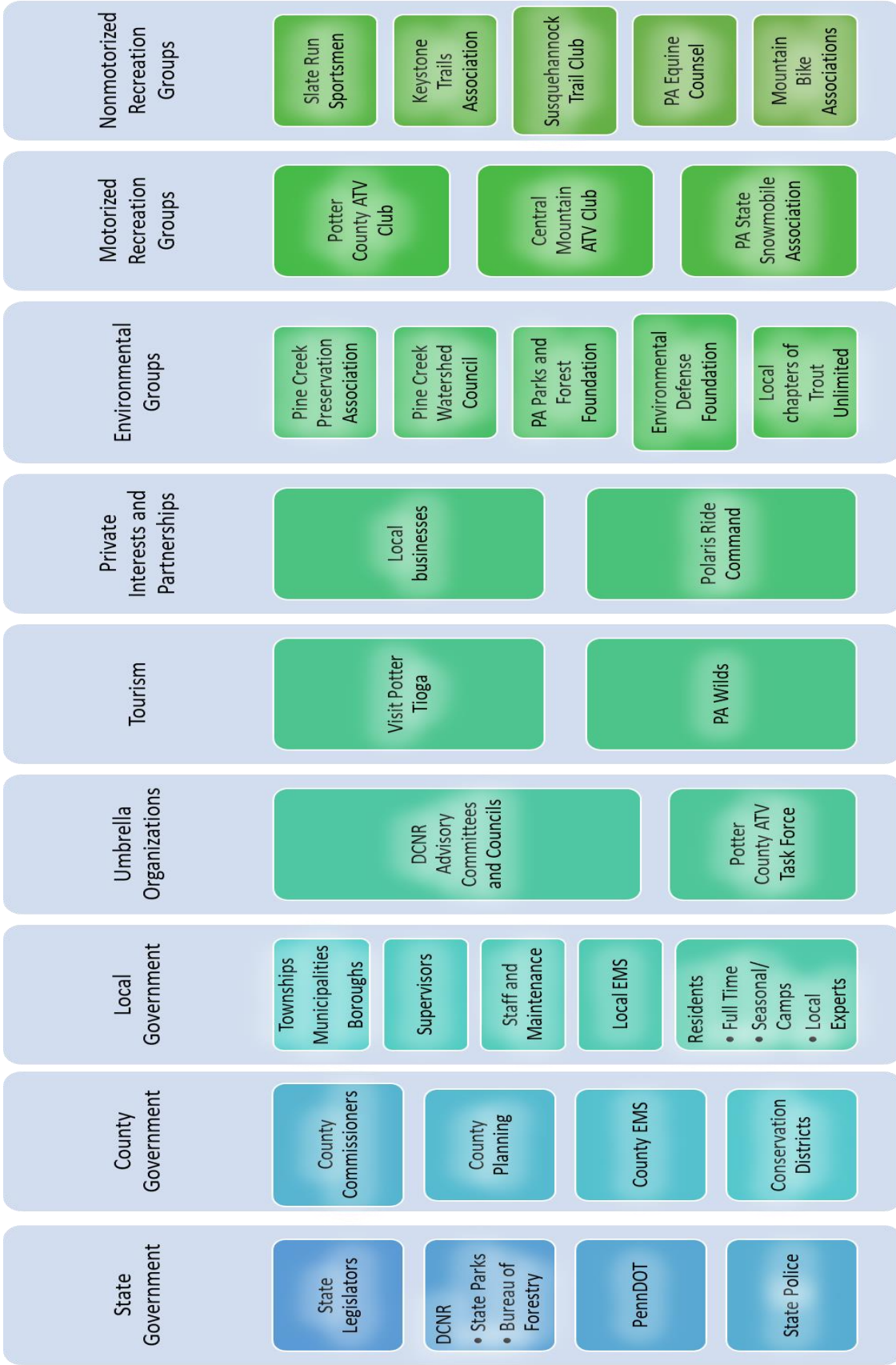


Figure 4: Stakeholders that provided feedback to DCNR on the ATV Pilot, grouped by type. Source: (DCNR Manager Interview, 2023; Stakeholder Interview, 2024)

As discussed earlier, rather than reach out to all stakeholders initially, DCNR managers tried to anticipate the concerns of many of the environmental and recreational groups and find ways to minimize impacts. They successfully anticipated many of the concerns—however, they were not able to address all of the concerns because some were out of their control. This is discussed later in Chapter 4, Section V. DCNR included the other groups during the implementation and monitoring of the ATV Pilot. These stakeholders were included based on their involvement with an advisory committee, local relevance, or if they approached DCNR with an interest in participating (DCNR Manager Interview, 2023; Stakeholder Interview, 2024).

II. Stakeholder Characterization

Stakeholders are often characterized and grouped by various factors including power relations; interest in the project; attitude towards the project; potential conflicts and coalitions; access to resources; political influence over the project; degree of implication, power, urgency, proximity, and legitimacy; and scale of influence. Characterizations should be done consciously through mapping stakeholders and identifying links and relationships. These analyses are subjective and should be done by several people to eliminate bias (Luyet et al., 2012). In this case, the stakeholders were characterized based on political influence over the project, power relations within DCNR, access to resources, and interest in the project (Luyet et al., 2012).

Stakeholders were characterized based on their importance to achieving the overall goals of the ATV Pilot—to connect the four existing ATV Trail systems to one another; pass by local

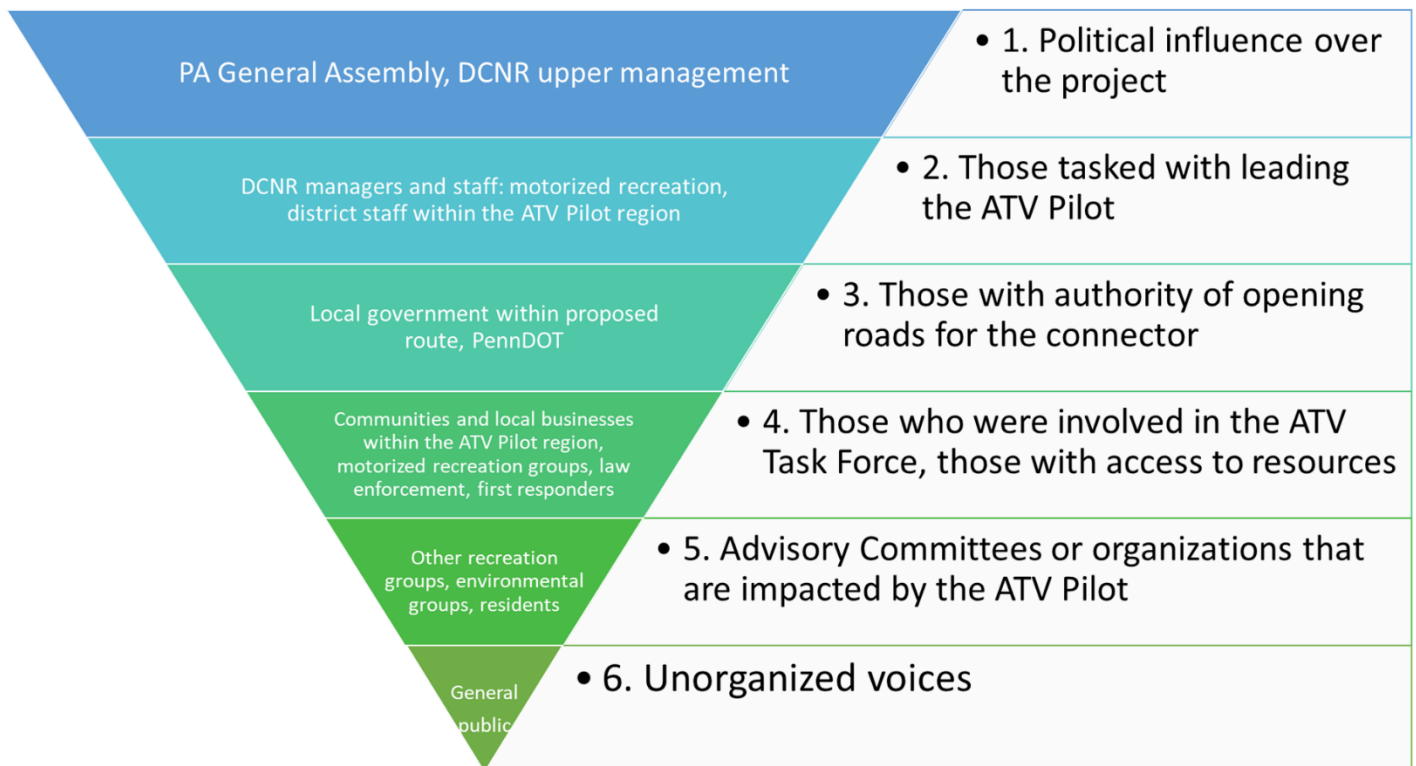


Figure 5: Stakeholder characterization reflects a top-down approach. Sources: (DCNR Manager Interview, 2023; Stakeholder Interview, 2024)

businesses to provide economic opportunities; and create long-distance riding opportunities—while striving to minimize negative impacts on the communities and environment. This started with the General Assembly and DCNR senior management, who had political influence over the project (Figure 5). Next involved were those who were tasked with leading the ATV Pilot. They had to conduct their planning in a practical and efficient manner due to the 6-month time constraint imposed by the PA General Assembly. As outlined earlier, DCNR managers worked internally to determine routes that were feasible. Then, they reached out to stakeholders who had access to the authority of whether to include a road in the proposed route. These were prioritized and included PennDOT and local government. Next were stakeholders with specific recommendations and concerns related to the planning and implementation. These groups were accepting of the ATV Pilot with certain conditions or recommendations. In addition to the authorities listed above, this also included communities and local businesses wanting to be connected, ATV clubs, snowmobile clubs, law enforcement, and first responders. These were the types of groups that made up a large part of the ATV task force. Their feedback was used to push the pilot in various directions, when feasible, as well as provide feedback in relation to logistics, such as signage. Occasionally, an environmental group or resident would approach the DCNR managers with specific concerns about routing that were also addressed. The other stakeholders were on the periphery and involved by DCNR in an effort to inform, build relationships, and gain trust. These were the recreation groups, environmental groups, and residents. These types of groups had varying types of access to participation. Finally, unorganized voices were invited to participate on the public platforms, given they knew about it, or they became involved by reaching out on their own initiative (DCNR Manager Interview, 2023; Stakeholder Interview, 2024).

III. Stakeholder Structuration and Degree of Involvement

Stakeholder structuration analyzes how managers arrange stakeholders into groups and assign a degree of involvement. Stakeholder structuration is based on how stakeholders are characterized in the previous step. The degrees of involvement identified by Luyet et al. (2012) are information, consultation, collaboration, co-decision, and empowerment. These are explained further in the analysis below. Typically, the degree of involvement is decided by the leaders of the project and is often subjective. Assigned structure and degree of involvement should be intentionally planned. Luyet et al. (2012) propose including several experts or stakeholders to help identify the degree of involvement and overcome subjective bias.

This section looks at DCNR's past practices of structuring and involving stakeholders, reviews the structuring of stakeholders in the ATV Pilot, and discusses the degree of involvement.

A. Comparison to Past Practices

Historically, district foresters were mostly concerned about the forest in their district and did not engage much with those not involved in their conservation efforts. District foresters are increasingly expected to build relationships with the communities surrounding the state forest and the county government to help when future collaborations are needed. However, due to the scale of the ATV Pilot, many of the local governments were not directly adjacent to a state forest and had not been previously engaged (DCNR Manager Interview, 2023).

DCNR has done stakeholder input for other projects, such as their management plan and the oil and gas development. Based on past practices, their agency-wide channels for stakeholder structuring and involvement are generally advisory committees and councils, press releases, public meetings, public surveys, sharing district activity plans, and responding to social media and comments. Typical stakeholder involvement processes usually take years before implementation. For the ATV Pilot, managers attempted to follow these practices, used additional targeted stakeholder outreach, and conducted an environmental review. However, DCNR managers only had 6 months of planning before implementing the ATV Pilot. As a result, DCNR managers did not meet with the other stakeholder groups until late May, when they were confident that it would become a reality. In this aspect, the stakeholder engagement did not follow DCNR's typical process because there was a rush to meet the deadline to open the ATV Pilot. Afterward, they had to "catch up" with their traditional forms of stakeholder engagement—the advisory committees, annual feedback meetings with county and township stakeholders, a channel for feedback through email, and an informational webinar open to the public (DCNR Manager Interview, 2023; DCNR, State Forest Resource Management Plan, 2016).

DCNR relied on established representative structures to provide updates and disseminate information through the ATV Pilot. In addition, the monitoring project gave additional opportunities to engage and report on stakeholder feedback. Finally, local champions helped take on some of the stakeholder engagement through the county task force and a local ATV club.

B. Advisory Committees/Council

DCNR has the Conservation and Natural Resources Advisory Council (CNRAC), which was written into law in Section 315, Act 18 of 1995. The members are appointed by the PA governor, senate president pro tempore, and speaker of the house. Currently, this council has a range of participants, including those with careers in county government, geoscience, forestry, environment, outdoor recreation, county planning, economic development, and health (DCNR, Conservation and Natural Resources Advisory Council, 2024).

The advisory committees have members from specific groups rather than government appointed. During the ATV Pilot, the Snowmobile and ATV Advisory Committee (SAAC), Trails Advisory Committee (TAC), and Ecosystem Management Advisory Committees were engaged.

The Snowmobile and ATV Advisory Committee was also written into law in 1991 through the PA Vehicle Code and includes federal representation from the Allegheny National Forest (ANF); representation from the General Assembly, PA Game Commission (PGC), and Department of Community and Economic Development; county and local government representation; and DCNR secretary-appointed representatives from NGO's. The purpose of SAAC is to advise the Secretary of DCNR on regulations, policies, practices, acquisition, construction and maintenance, enforcement, and allocation of fees (Assembly, Title 75, 1991). SAAC has been updated on the ATV Pilot during its biannual meetings and given the opportunity to provide feedback (Snowmobile and ATV Advisory Committee, 2022).

The Trails Advisory Committee (TAC) includes 20 volunteers from a DCNR-appointed committee representing motorized and non-motorized groups (DCNR, Pennsylvania Trails Advisory Committee, 2024).

The advisory committees provided feedback on the monitoring project and were updated with its results. The structure of the advisory committees allowed DCNR to reach a wide range of representatives from stakeholder groups. However, by relying on these groups, they were not able to meet with many groups individually. Also, one stakeholder reported the meetings being too structured and more informative rather than seeking feedback. If DCNR's assigned degree of involvement was solely informative or consultative, this stakeholder had a misconception about their level of participation, intended types of feedback, and clearer expectations need to be defined (DCNR Manager Interview, 2023; Stakeholder Interview, 2024).

C. Monitoring Project

The monitoring project also provided a platform for stakeholder engagement. As part of the studies, stakeholders' opinions were collected from various groups including the public, ATV riders, local businesses, residents, DCNR staff, and intercepted hikers. The environment, a non-human stakeholder, was also engaged during the environmental portion of the monitoring study. These results contributed to the future direction of the ATV Connector, were shared with stakeholder groups, and presented to the General Assembly (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023; DCNR Manager Interview, 2023).

D. Local Champions Step Up to Fill the Gaps

During the early stages of planning for the ATV Pilot, rumors circulated among the communities and many stakeholders began to ask questions. To address this gap in information, local champions stepped up and helped with the stakeholder outreach. Their involvement helped facilitate communication (Stakeholder Interview, 2024). Below are two examples of local champions:

The ATV Task Force was established by a local champion in county government in June 2021 and helped disseminate information from the state level to the local government and residents and provide a voice for their recommendations or concerns. The task force was designed to be temporary—only during the “pilot” period—until a more formal structure could be provided. The task force started with about 15 participants and grew to over 40 over time, as the interest and awareness for the pilot grew, although not all participants were always active. The task force included representatives from state police, state parks, tourism agencies, recreation groups, first responders, and law enforcement. Other members joined as the ATV Pilot evolved (Stakeholder Interview, 2024). One stakeholder believed that the planning process would have taken much longer and stakeholders would be less informed if it were not for the ATV Task force—the task force helped improve communication and efficiency (Stakeholder Interview, 2024). Feedback from DCNR managers also aligns with this: one manager stated that the same level of involvement from stakeholders would have not happened without the task force. The task force provided a platform for more continuous information sharing and ongoing dialogue (DCNR Manager Interview, 2023).

Another local champion—a member of the local ATV club—stepped up and helped with some of the stakeholder engagement by communicating with local government and residents. This involved providing information, listening to their feedback, building relationships, and communicating their concerns to DCNR (Stakeholder Interview, 2024).

This involvement from local champions helped manage the differing attitudes toward the ATV Pilot. The Task Force showed there was organized involvement of multiple agencies and gave the project legitimacy. The outreach by the local ATV club showed they are organized, professional, and often family-oriented, which helped counter the stereotype of an ATV rider being rebellious or destructive (DCNR Manager Interview, 2023).

On the other hand, in response to feeling as though their interest were not being represented, stakeholder groups that were opposed to the project structured their own methods of providing input that were not provided by DCNR. This included advocacy against the project through separate meetings and outreach, a video, and a lawsuit against the Pennsylvania General Assembly for the nature of the legislative mandate (DCNR Manager Interview, 2023; Stakeholder Interview, 2024). The implications of this advocacy are unclear. While it helped inform some stakeholders about the potential negative impacts of the ATV Pilot and provided information for DCNR’s monitoring report, no concrete changes were reported as a result of the advocacy. The advocacy that was done through meetings, outreach, and the video could have been a result of DCNR’s failure to engage stakeholders earlier. The lawsuit was directed at the legislature rather than DCNR and disputed the entire decision to have an ATV Pilot.

E. Degree of involvement

Figure 6 categorizes the various methods of stakeholder participation practiced by DCNR during the ATV Pilot, based on what was reported by DCNR Managers.

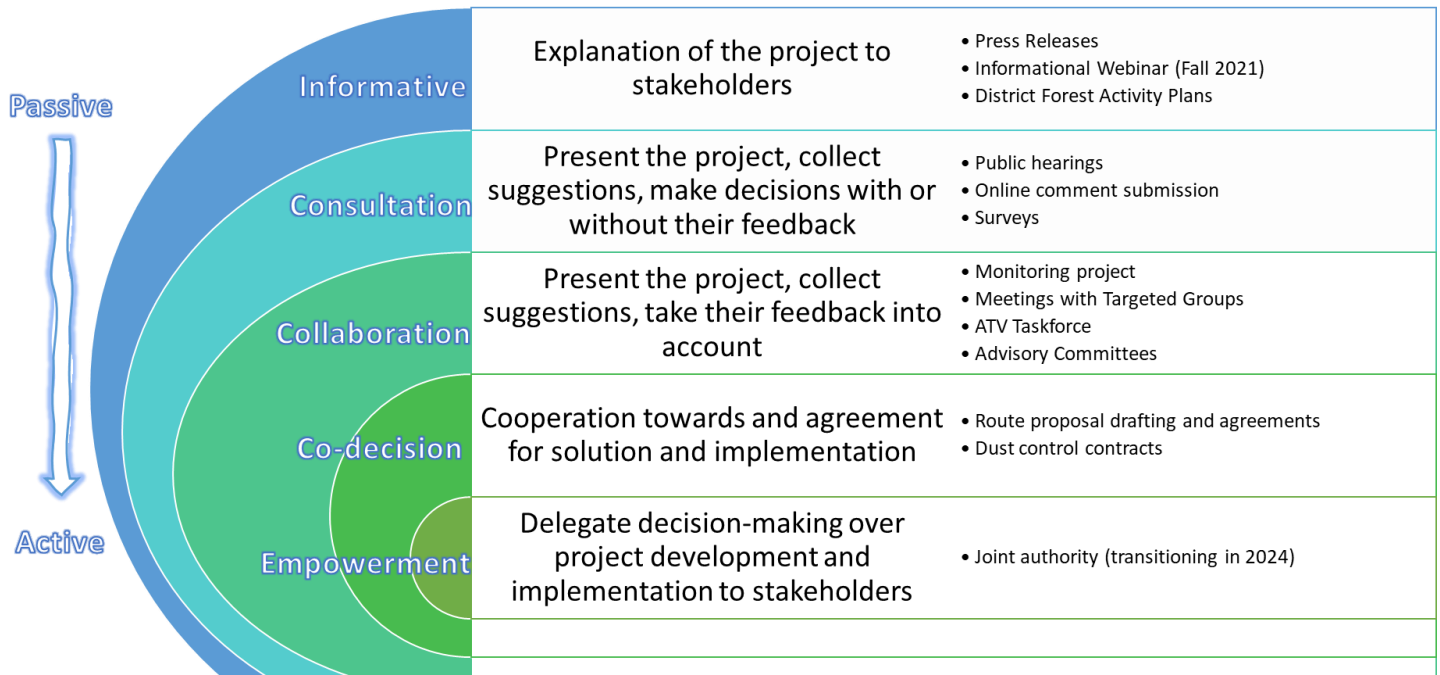


Figure 6: Methods of stakeholder participation practiced by DCNR during the ATV Pilot, categorized by degree of involvement. Source: (DCNR Manager Interview, 2023; Stakeholder Interview, 2024)

Originally, this study attempted to compare the stakeholder's perceived degree of involvement with DCNR's stated degree of involvement. Their degree of involvement is loosely based on the stakeholder characterization and structuration discussed earlier. However, the results of the interviews revealed that there were differences within stakeholder groups and that the degree of involvement was impacted by other factors. For example, some stakeholders' degree of involvement was self-induced—either they were local champions and they stepped up to create additional opportunities to be involved, or they were asked to participate but did not feel they needed to contribute anything. Other stakeholders may have experienced stakeholder fatigue. This occurs when there are too many stakeholder engagement opportunities without a well-run, high-quality process or with little reward or influence over the project (Reed, 2008). Other interview participants joined the project later because they began a new position in their careers, so their degree of involvement was delayed. Still, others felt disillusioned by the process and felt it was hopeless to provide substantive feedback. Also, individual stakeholders' experiences that were recorded in the interviews cannot represent the entire group, so it is not accurate to say that an individual's reported experience reflects the entire group's experience. Instead, the interviewed stakeholders' perceived degree of involvement is summarized in Table 2, along with whether they felt satisfied with this level of participation.

The data in Table 2 is not meant to be quantitative. Overall, state government agencies were

Type	Organization	Method(s) of involvement with DCNR, as described in interview	SH perceived degree of involvement as described in interview	Notes on satisfaction with involvement
State Government	DCNR Managers	Project leaders	co-decision	<i>Would have liked to have other agencies assigned shared authority over the project in the Fiscal Code</i>
	State Legislature	Drafting FC, communication with constituents	collaboration	<i>Satisfied with degree of involvement</i>
	PennDOT	direct communication	co-decision	<i>Satisfied with degree of involvement</i>
County Government	County Planning or GIS	ATV Task force	collaboration (1), informative (2)	<i>Satisfied overall: 2/3 said they would have liked to be involved earlier</i>
	Community Development	ATV Task force	informative	<i>Neutral</i>
	911 Dispatch	ATV Task force	informative	<i>Neutral</i>
Local Government	Township supervisor	ATV Task force, direct communication	co-decision, collaboration	<i>Satisfied overall: Communication could have been better in the beginning</i>
	Township staff	direct communication	consultation	<i>Doesn't feel like concerns were taken seriously</i>
Private	Private Partner	ATV Task force, direct communication	collaboration	<i>Satisfied with degree of involvement</i>
	Local businesses*	direct communication, public meetings, survey	consultation, informative	<i>Varied levels of satisfaction</i>
NGO	Tourism	ATV Task force	informative	<i>Satisfied, but unsure whether their participation was helpful</i>
	Motorized Groups	ATV task force, direct communication, advisory committee	consultation	<i>Satisfied overall but would have liked more interaction</i>
	Environmental groups	advisory committees, survey, public hearings	informative, consultation	<i>Varied: 1/3 felt their participation was fitting; 1/3 felt the entire public was bypassed by the fiscal code; 1/3 was appreciative that DCNR reached out</i>
	Nonmotorized Recreation Groups	advisory committee, survey, public hearings	informative, consultation	<i>Not satisfied: 1/2 felt the engagement was not substantive. 1/2 felt it was hopeless</i>
Individuals	Seasonal Resident	direct communication, public meetings	consultation	<i>Satisfied with engagement with DCNR; not satisfied with engagement with township</i>
	Local experts	direct communication	informative	<i>Not satisfied.</i>

**Data from local businesses was collected during a different study on economic impact and is not conclusive for this particular study*

satisfied with their involvement. However, DCNR managers expressed that it would have been more efficient to have other agencies involved at the same level as them. DCNR's level of involvement was assigned by the Pennsylvania General Assembly's legislative mandate. The county government had varying levels of involvement, depending on their location in relation to the ATV Pilot. Several expressed that they would have liked to have been informed and involved earlier. This would have helped them give accurate information to their constituents. As mentioned earlier, the ATV Task Force was created by a local champion in county government to fill this gap. Those involved in the ATV Task Force had

varying degrees of involvement based on their interest in the project. Some were satisfied with just being informed, while others provided feedback. Townships had varying degrees of involvement—one would have liked to have known about it earlier. Another township opted out of the program the second year because they felt like their concerns were not addressed. Factors that impacted township involvement and interest varied depending on the number of local businesses, local buy-in, resident satisfaction, and the particular routing proposals.

A private partner was satisfied with their degree of involvement. Local businesses had varying levels of satisfaction, mostly related to whether their business was connected—which often depended on other jurisdictions—but many expressed the desire to know more and have information to give to customers. Since the local business interviews were conducted as part of the economic impact study in 2022 and early 2023, there has not been any follow-up on whether this has improved.

NGOs were extremely varied depending on the interest of the particular stakeholder group. The motorized, nonmotorized, and environmental groups all would have liked more engagement with DCNR. One environmental group felt the entire public was bypassed as a stakeholder by the nature of the legislative mandate. Other environmental groups were appreciative that DCNR involved them but knew their overall concerns could not be addressed. The nonmotorized recreation groups were not satisfied—one felt that the number and type of opportunities to participate was equitable, but not substantive; another group did not participate but was under the same impression that stakeholder engagement was a formality and participation was futile. These negative sentiments are because DCNR was tasked with *how* to establish an ATV pilot, and not *whether they should*. That decision was already made in the legislative mandate (Stakeholder Interview, 2024).

The stakeholder feedback on their degree of involvement reflects what DCNR acknowledged in their manager interviews. Due to the time limit, they did not involve many of the groups until just before the ATV Pilot opened because they were so busy just trying to handle the logistics. Even after the ATV Pilot opened, DCNR did not have the resources available to engage stakeholders as much as they would have liked (DCNR Manager Interview, 2023).

IV. Choice of Participatory Technique

The choice of participatory technique can depend on many factors, such as the assigned degree of involvement, prior experience and knowledge, cultural norms, past events, timeline of the project, and knowledge and experience of managers. The framework recommends applying several participation techniques to a stakeholder group (Luyet et al., 2012).

This section discusses the type of stakeholder opportunities that were offered to different groups. DCNR provided multiple avenues for stakeholder participation, as shown in Table 3. These are all traditional modes of participation (Rowe & Frewer, 2000). Their choice of participation techniques reflects DCNR managers' prior experience and each group's degree of involvement. Their decision of which technique to use and when to use it also reflects their key constraint, which was time (DCNR Manager Interview, 2023).

Table 2: Stakeholder participation methods in interviews. "S" indicates the method of involvement was mentioned by the stakeholder and "D" indicates that the method of involvement was mentioned by a DCNR manager. Source: (DCNR Manager Interview, 2023);

Type of Stakeholder Participation Mentioned in Interviews	State Legislator	PennDOT	State Police	Other State Agencies	County	Local Gov	Local Emergency Response	Local Resident	Local Expert	Private* Tourism	Environmental	Motorized Rec	Non motorized Rec	General Public
DCNR														
Communication with DCNR Upper Management	D					S/D	D	S/D	S	S	S/D	D	S	
Communication with DCNR Managers or district staff		S/D	D		S/D	S/D		S/D	S	S/D	S/D	D	S/D	
DCNR Advisory Committee/Council	D			D						D	D	S/D	S/D	
DCNR Survey						D		S/D	S		S	D	S	D
Letter to DCNR									S		D		S	D
Annual Feedback Meeting					D	D	D					D	S/D	
Monitoring Studies					D	D		S/D		D		D	D	D
Comment Submission											D		D	D
Informational Webinar													S	D
Press Releases, Published Reports & Plans								S/D	S		S		S	D
State														
Communication with State Legislator												D		
Letter to Legislator		D								S	S		S/D	
Senate Public Hearing											S/D	D	S/D	
Lawsuit Against State Government											S/D		S	
County														
Communication with County Commissioner						S/D	D			S/D	S/D	D		
ATV Task Force			D	D								S/D	D	
Local Government														
Township Meeting						D		S		S/D	D			
Communication with Local Government	S				S		S/D			S		S		
Communication with Residents	S				S		S				S			
Other														
Survey within Group								S					S	
Advocacy Video									S/D		D		S/D	
Personal/Group Advocacy								S			S	D	S	
SH Specified no Interaction with DCNR													S	
**Includes information from one interview with this for this study and 3 interviews for the separate economic impact study. **Includes method of involvement mentioned by DCNR Manager Interviews														

Table 3 shows the various methods of stakeholder involvement mentioned by DCNR Managers and stakeholders in their interviews. “D” indicates methods of involvement mentioned by DCNR Managers; “S” indicates methods mentioned by stakeholders. These results are not conclusive because some interviewees may have forgotten a method of involvement. Since the interviews were conducted in the fall of 2023 and spring of 2024, interviewees may have forgotten a degree of involvement or gotten a specific mode of involvement confused with another. For example, some stakeholders were unsure whether they participated in a public hearing or a township meeting. Also, not all groups within a stakeholder type were interviewed. This explains some of the differences between what DCNR Managers and stakeholders reported.

Table 3 helps demonstrate where certain groups tended to be more involved than others. For example, state legislators were found to only be involved with DCNR senior management, their constituents on the local level, and advisory committees/councils to some degree. This makes sense because the legislator stated they supported the FC Mandate because it was reflective of what they heard from their constituents. It also aligns with what DCNR reported about how their senior management was aware of the legislative mandate before it was passed—reflecting a top-down approach to management. Some state legislators are also represented on the CNRAC Advisory Council.

The types of involvement of other state agencies reflect the disconnect in the structuring of the legislative mandate and how it did not involve all parties with jurisdiction. State police were reported to not be interested in participating. They met with DCNR management in 2018 before the ATV Pilot; and were invited to the ATV Task Force but were not active (DCNR Manager Interview, 2023; Stakeholder Interview, 2024). They also declined to interview for this study. PennDOT collaborated but did not play a central role because they were not legally tasked to. Therefore, their participation mainly consisted of communicating directly with DCNR managers. This reflects the inefficient process of approving or revising route proposals, where DCNR managers had to communicate back and forth between local government and PennDOT to negotiate routes. The other state agencies were involved on an informative basis by being invited to the ATV Task Force and advisory committees/councils (DCNR Manager Interview, 2023).

Counties and local governments were involved through direct communication, annual feedback meetings, and the ATV Task Force. They also communicated with their constituents to try to reflect their needs at these meetings. This represents additional tiers to the top-down management structure.

Other stakeholder groups participated in a variety of ways. In terms of groups that communicated directly with DCNR management, this tended to be regarding specific concerns, such as in relation to a proposed route. District foresters had some of the more general conversations with these groups to raise awareness and listen to their concerns or recommendations but had less power over decision-making. One local non-motorized group reported not interacting with DCNR at all—they were not invited to participate and did not reach out to participate because they felt it was “futile” and everything had already been decided. Unfortunately, this reflects the challenges of the time constraint—many groups were

not involved until DCNR was sure the ATV Pilot was feasible, which was right before it opened. The legislative mandate required there to be an ATV Pilot, so the question was not “*Should?*” but “*How?*” One stakeholder from an environmental group reported: “It was a matter of how to rearrange the seats on the Titanic” (Stakeholder Interview, 2024).

It is interesting that prior to the ATV Pilot, the efforts to create ATV connectors reflected grassroots efforts. Local ATV clubs worked with their local, county, and state representatives. They convinced many local townships to open their roads to ATV riding. However, they always faced resistance from the moratorium on ATV trail expansion (and perhaps resistance from the stakeholders that are opposed to ATV expansion on DCNR lands), as resistance from PennDOT. Therefore, the top-down approach with the legislative mandate finally got the job done.

The public on a statewide level was also involved through information sharing, comment submissions, and surveys. However, these were only provided to those with knowledge of and ability to access them. Overall, DCNR offered multiple different types of participation for all stakeholders, provided they were informed and had access. Next, the study looks at how effective these types of participation were to both the stakeholders and managers.

V. Implementation of Participatory Techniques

To successfully implement a participatory technique, it needs to be publicized appropriately to the intended audience. Clear rules and explanations of the participation process will help stakeholders to remain active. If a participatory technique is not implemented appropriately, it can lead to mistrust and frustration from the stakeholders (Luyet et al., 2012).

The implementation of participatory techniques looks at the level of participation, outcomes, goals achieved, and early involvement. This section reveals the results of when stakeholders found out about the ATV Pilot, what their feedback was, and how it was addressed.

76% of the stakeholders interviewed reported being asked by DCNR to participate at some point during the ATV Pilot (Figure 7). Of those not asked to participate included 2 local experts, a local nonmotorized recreation group, an environmental group, and a local fire department.

Although 76% were asked to participate at some point, the majority did not find out about the ATV Pilot through DCNR (Figure 8). The majority said they found out by word of mouth. This means that rumors were circulating ahead of the actual news. Part of this is because DCNR was unsure if the ATV Pilot would even be feasible until the last minute. They chose not to reach out to certain groups until they were certain that it was

happening (DCNR Manager Interview, 2023). It is interesting that the environmental groups were the second most frequent category cited for spreading the word. Their outreach was mentioned by nonmotorized groups and other environmental groups (Stakeholder Interview, 2024).

A. Early involvement

DCNR Management was transparent in their interviews about the lack of early involvement for many of the stakeholder groups. They attributed this to the 6-month timeframe from the passing of the legislative mandate (which was when many of the DCNR Managers found out about it) and when the ATV pilot was expected to open (DCNR Manager Interview, 2023).

Reporting from the stakeholder groups also reflects this. Many of the stakeholders were not sure exactly when they found out about the ATV Pilot. Therefore, not all the responses were definite but were recorded as accurately as possible. The two groups that reported hearing about the ATV Pilot in 2018 were involved in the 2018 legislative mandate and had been following the ongoing development of the Northcentral ATV Initiative. One group reported hearing about it in late 2020. Eleven reported hearing about the ATV Pilot in early 2021 or spring of 2021. Another three said they found out about it in 2021 but could not specify when. Two reported hearing about it after it opened (Stakeholder Interview, 2024).

B. Concerns by Stakeholders

Table 4 lists the concerns that were listed by stakeholders in their interviews and whether the stakeholders felt their concerns were adequately addressed. The most listed concern was the enforcement of the rules and regulations. This is likely the most popular concern because it was listed by all stakeholder groups and is a broad concern that has implications for the environment, safety, and quality of life. Slightly over half of the participants felt like their concerns for enforcement were not addressed. Three participants were “unsure” because they felt like it was being worked on and they have not yet observed the impacts of minimal enforcement. One stakeholder provided a more detailed law enforcement concern that DCNR

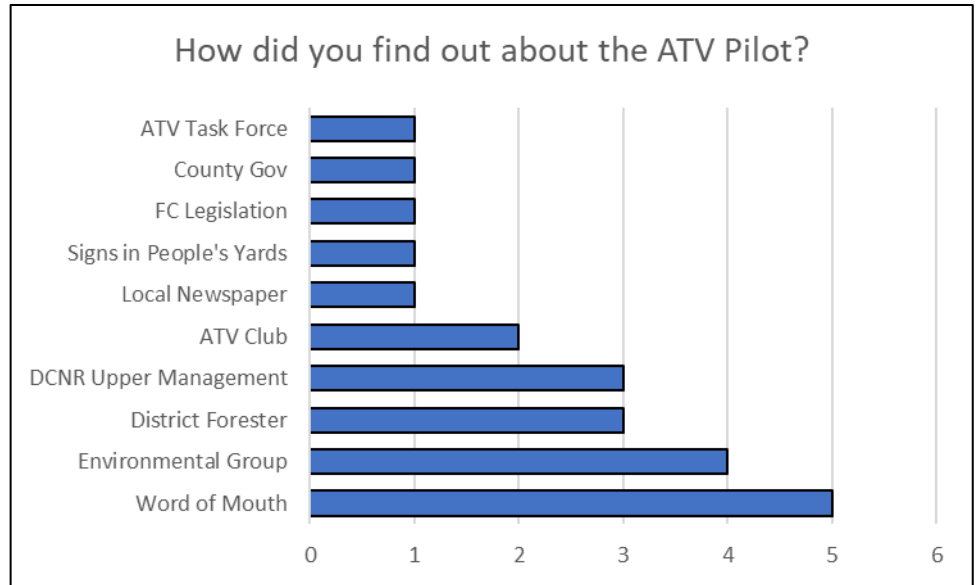


Figure 7: Stakeholder reporting of how they first found out about the ATV Pilot. Source: (Stakeholder Interview, 2024)

Rangers are not allowed to pursue violators or administer breathalyzers (Stakeholder Interview, 2024).

Table 3: Stakeholder concerns, the frequency they were mentioned, and whether the stakeholder felt their concerns their concerns were adequately addressed. Source: (Stakeholder Interview, 2024; Local Business Interview, 2023)

Concern	Frequency	Adequately Addressed?		
		Yes	No	Unsure*
Enforcement	8		5	3
Dust	7	3	4	
Safety	7		5	2
Noise	7		6	1
High impact sport should not be supported by DCNR	6		6	
High costs / Opportunity Costs / Deferred Costs**	5		5	
Increased pressure on DCNR to support ATV trail development	5		5	
Environmental monitoring is limited	5		5	
Concern about a specific habitat/area	4	4		
Potential for Illegal trails / Fragmentation / Degradation of Natural Resources**	4		4	
Road maintenance	3		1	2
Litter / Traffic / Trespassing**	3		2	1
ATV not made for dirt/gravel	3		3	
Erosion / Pollution**	3		3	
Recreation conflict	3		3	
Disruption to wildlife	2		2	
Usage of FC to bypass public / Levels of public opposition**	2		2	
Invasive plants	2		2	
Environmental rights of constitution	1		1	
Impact on state parks	1		1	
Wild character	1		1	
Stone on snowmobile trail	1		1	

**Addressed as much as possible but still an ongoing concern. **Similar categories that had the same number and type of responses were combined*

The second most common concern—dust – was cited by both environmental groups and those representing resident concerns. The environmental groups did not feel it was adequately addressed, while the groups representing resident concerns felt that it was managed by dust suppressant agreements and reimbursement programs. DCNR Managers confirm that the dust reimbursement program was a direct result of stakeholder involvement (DCNR Manager Interview, 2023). These top two concerns align with those cited in the General Assembly Report (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Safety, noise, road maintenance, litter, traffic, and trespassing were all concerns that were listed that the respondents either felt they were not addressed or were unsure. Some had a more positive outlook on safety because they thought the permitting requirements, education, and proper signage would help reduce the number of safety incidents. One participant felt that noise could be managed in the future by dispersing the ATVs along different routes. Two out of three participants had a positive outlook about road maintenance and felt like it would be worked out in future planning. Participants who had a more positive outlook about litter, traffic, and trespassing with the help of increased law enforcement and education and

opening more roads. Although those who were “unsure” had more positive outlooks that these challenges could be worked out in the future, they still mentioned that it was an ongoing concern (Stakeholder Interview, 2024).

Another type of concern that stakeholders felt was adequately addressed involved avoiding specific habitats or natural areas. There were three separate instances where the proposed routes were changed because of these specific concerns. However, all four of these stakeholders also expressed broader concerns about the environment and potential damage resulting from illegal trails that were not addressed (Stakeholder Interview, 2024).

All other concerns listed were not adequately addressed, according to stakeholders. This is because many of these concerns are broad, in reference to the future long-term implications, and not in support of the ATV Pilot. The monitoring studies were three years at most, but some only included one or two seasons. Stakeholders reported that environmental damage can take longer to detect. They expressed that illegal trails have a high potential for ecological damage, even from just one incident. Some stakeholders were concerned that DCNR would be pressured to open more areas to ATV riding in the future. Others were concerned that DNCR employees would feel internal and political pressure to support the ATV Pilot, which the stakeholders claimed had been expressed by two former DCNR employees (Stakeholder Interview, 2024).

In the DCNR Manager interviews, many of these concerns were acknowledged but considered outside of their control: the broader environmental concerns, safety and enforcement, and externalities experienced by residents. Their answer to this was continued monitoring, reporting, and adapting (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

C. Recommendations by Stakeholders

Table 5 lists the recommendations that were mentioned in stakeholder interviews and whether the stakeholders feel as though they were adequately implemented. The most frequently mentioned recommendations were in relation to signage, accessing more communities and businesses, and accessing additional services.

Signage recommendations were adequately implemented according to three stakeholders. Other signage recommendations were mentioned by businesses and were in relation to a specific area—it is unsure if these were addressed. Many of the businesses wanted their roads open and accessible to ATVs. Since these were related to specific routing and subject to various jurisdictions, implementing these connections is an ongoing process. Recommendations that were addressed include permitting conditions and processes; input on mapping and navigation; and opening more state forest roads to take riders away from residents.

Table 4: Stakeholder recommendations, the frequency they were mentioned, and whether the stakeholders felt they were adequately implemented. Source: (Stakeholder Interview, 2024; Local Business Interview, 2023)

Recommendations	Frequency	Adequately Implemented?		
		Yes	No	Unsure*
Signage	5	3		2
Access more communities/businesses	5	1		4
Access to additional services (parking, gas, bathrooms)	5		1	4
Easier access to information and maps for businesses	3			3
Permitting conditions and process	2	2		
More logic to flow of trails	2			2
Input on mapping and navigation	1	1		
Open more SF roads to take riders away from residents	1	1		
Expand to manage traffic volume	1			1
Increasing efficiency	1			1
Create partnerships with private landowners	1			1
Allow dealers to issue registration	1			1
Volume controls on radios	1		1	
Specific connection involving bridge closure	1		1	
<i>*Recommendations are being taken into consideration for future planning</i>				

While many of the concerns were not addressed, most of the recommendations were either addressed or in the process of being addressed. This is likely because the recommendations are more specific, concrete, and, overall, in support of the ATV Pilot.

D. DCNR’s Response to Feedback

Below is a summary of how DCNR Managers addressed feedback. Additional details of this are found in their General Assembly Report, which includes the results from the monitoring study (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Law Enforcement

DCNR reported that they could only control state forest lands. They reached out to local law enforcement to attempt to create an agreement with the local law authorities. This originated through public meetings, but it is limited because many local governments only rely on state police. The BOF also brought in rangers from other districts to try help. However, BOF rangers only have authority on state forest roads or township roads with state forests on both sides. BOF rangers focused on those roads to have a visible presence. They also went to other areas to have a visible presence, even though they had no authority. According to DCNR Management, concerns about law enforcement have decreased over the years as the ATV

Pilot demonstrated that the majority of the ATV riders were not interested in illegal activity. However, they acknowledge that there were some instances, which have been recorded in their monitoring report (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

These concerns are trying to be addressed under the future regional authority of the ATV Pilot and might look like providing incentives for local fire, EMS, and law enforcement responders provided by ATV revenue. However, the ATV Pilot covers a vast, rural area, and the reality of a law enforcement officer being close enough to respond to an incident is unlikely. The areas outside the state forest could benefit from more law enforcement support (DCNR Manager Interview, 2023).

Environmental

In reference to the specific concerns about proposed routing affecting habitats: DCNR Managers reported exploring multiple options to avoid these areas. In one instance, they negotiated with PennDOT to find an alternate route. In another instance, they chose to open an alternate segment of state forest road to avoid a road passing a vernal pool and high-quality trout stream. Unfortunately, part of the road along the stream is a township road and was still included on the map as a dead-end road, but the decision to open this road was outside BOF jurisdiction. The third instance was dealt with by ending the ATV Route and keeping parking separate from a scenic vista (DCNR Manager Interview, 2023).

The DCNR Managers reported that they addressed the broad environmental concerns as much as they could by trying to avoid sensitive areas, using existing roads and trails, and avoiding many of the state forest roads. They reported that DCNR worked hard to fulfill their constitutional obligation of providing healthy environmental resources for present and future generations; the ATV Pilot aligned with those obligations and did not conflict with other state forest uses. They reported that this claim is backed by the monitoring team's research on the environmental impact of the ATV Pilot on state forest lands and these impacts will continue to be monitored (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

Dust

DCNR addressed concerns about dust by creating a dust suppression program, which helped townships pay for dust suppression (DCNR Manager Interview, 2023). The first year, this program was only about to provide some monetary relief, due to short notice. The dust suppressants had varying success in controlling the dust, which depended on the type of dust suppressant, and the application timing and weather. Only certain dust suppressants were allowed due to potential environmental effects (Stakeholder Interview, 2024).

Noise

Noise was addressed to a degree for recreation groups by avoiding certain areas. However, there was not much that DCNR could do for residents living along the ATV Pilot route. Since the routes that pass residents were usually not on state forest roads, it was under the authority of the local government. Residents would have to discuss with their local government about rerouting or closing roads to ATV trails (DCNR Manager Interview, 2023). This happened in one township due to noise, litter, and ATV riders relieving themselves on private property (Stakeholder Interview, 2024). In situations where noise or

dust concerned residents on a high-ATV-traffic portion of the route, DCNR encouraged townships and PennDOT to open multiple segments to disperse riders over a variety of options.

Road maintenance

Townships wanted to be compensated for increased road maintenance costs. They discussed their concerns with DCNR. This was something that DCNR hoped would be addressed under the regional authority (DCNR Manager Interview, 2023).

Access to businesses and services

Local businesses and certain townships approached the DCNR about wanting to be connected. They tried to connect to the local businesses when they could, but managers had to balance this with environmental concerns and jurisdictional feasibility. Providing access was dealt with on a case-by-case basis. Sometimes, when a state road was involved, PennDOT and the DCNR were unable to come to an agreement and that particular segment would not be approved. In another situation, a township decided they did not want their roads advertised on the map, even though they were open to ATV riding. DCNR responded by removing this route from the map and reevaluating the preferred route. When the route concerned state forest roads, DCNR managers used their Trail Assessment Worksheet to determine the best possible route. It would be up to individual townships to determine which other roads to use (DCNR Manager Interview, 2023).

Recreation Conflict

DCNR managers acknowledged that some recreation groups were concerned that the ATV Pilot would interfere with their activities. Snowmobile groups were concerned about the potential damage to the trails if they were shared with ATVs during the spring and summer. DCNR managers responded by resurfacing the joint-use trails to make them more durable. They would also grade the trails between ATV and snowmobile seasons (DCNR Manager Interview, 2023).

DCNR managers tried to minimize other recreational conflicts by avoiding areas popular for other forms of recreation (DCNR Manager Interview, 2023). Some stakeholders were concerned about the impact of development on wild character. This is more of a general concern about any development of the more remote areas of state forest. DCNR addresses this concern more generally in their planning—design facilities away from remote areas, as well as educating the public about the multiple uses of the state forest (DCNR Manager Interview, 2023).

Infrastructure

Local government and residents had concerns about lacking the infrastructure to accommodate the increased tourism that the ATV Pilot would bring. This was beyond the DCNR's authority, but they made note of it in their recommendations and it would hopefully be addressed under regional authority (DCNR Manager Interview, 2023; DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023).

VI. Evaluation of Stakeholder Engagement:

The final step of stakeholder engagement is evaluation so that improvements can be made in the future. Evaluation can be qualitative or quantitative and based on process or outcome (Luyet et al., 2012). DCNR Managers did not mention any formal method of evaluation.

However, there is some evaluation in their General Assembly Report. They provide a list of their public meetings and a summary of concerns and how the concerns were addressed (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). This is an evaluation based on the outcomes. However, they did not reach out to stakeholders to determine their level of satisfaction with their involvement.

For this study, DCNR Managers and stakeholders were asked in their interviews what could be improved in the process. Below is a summary of their responses.

A. DCNR Manager Reflections

Table 6 summarizes the DCNR Manager's reflections on what worked well and what could have been improved in the stakeholder involvement process. They had to learn and adapt as the ATV Pilot unfolded due to the time constraints and not having done a project like this before.

The most common reflection of what worked well was addressing stakeholder concerns. One manager reported that this was made more efficient by anticipating many of the stakeholder concerns in the initial planning. The managers also felt that they did a good job collaborating

What worked well	Frequency	Percentage
Addressing stakeholder concerns	4	80%
Collaboration	3	60%
Collecting feedback	3	60%
Transparency	1	20%
Anticipating stakeholder concerns	1	20%
Utilizing representative structures	1	20%
Adaptive management	1	20%
Best case scenario of managing the political pressure	1	20%
What could have been improved		
More time to plan	4	80%
More time to engage stakeholders	3	60%
Having DCNR as sole convener of Pilot	1	20%
Engage with more stakeholder groups	1	20%

with the multiple jurisdictions and collecting feedback. This was aided by using representative structures, such as county and local government, to act on their constituents' interests. One manager reported that the outcome was the best-case scenario, given the constraints and political pressure. One DCNR manager reported, "The way I experienced it felt like a freight train coming on. I think we steered things a little bit, but it was a big thing to steer, and it had enough political interest that it was going to happen no matter what. If we did nothing, it could have been a whole lot worse." In other words, DCNR senior management tried to steer the political pressure in a way that was compatible with state forest use and values (DCNR Manager Interview, 2023).

When asked what could have been improved, more time to plan and engage stakeholders was the most frequent response. DCNR's assigned role as sole convener of the pilot was mentioned once but alluded to in other interviews. It put a burden on DCNR to manage multiple jurisdictions and implement the ATV pilot, where they had a minority of

jurisdictional authority (DCNR Manager Interview, 2023). It is noteworthy that the aspects that could have been improved were all a result of the language in the legislative mandate.

DCNR Managers reported that stakeholder feedback on their monitoring report presentations has been mostly positive, even from groups that would normally oppose the project (DCNR Manager Interview, 2023).

B. Stakeholder Reflections

Stakeholders were also asked to evaluate their involvement. Table 7 shows the positive and negative themes from their interviews.

When asked what worked well, stakeholders most frequently mentioned that DCNR did a

What worked well	Frequency	Percentage
Overall good job	4	18%
Appreciative they were included by DCNR	3	14%
All necessary parties were involved	2	9%
DCNR is trying to fulfill the mandate in a responsible way	2	9%
DCNR did a good job educating people	2	9%
What could have been improved		
Stakeholder felt like the decision was already made	5	23%
Earlier information and earlier involvement	4	18%
More stakeholder engagement opportunities	4	18%
More outreach	3	14%
Higher quality of stakeholder engagement	2	9%
Received no response from DCNR	2	9%
Stakeholder received pressure to cooperate	1	5%

good job overall. Stakeholders from groups that did not have their concerns fully met reported that they were still appreciative that they were included by DCNR, and one participant added that their district forester was always accessible. Two stakeholders mentioned they felt all the necessary parties were involved. Others added that DCNR did their best to fulfill the legislative mandate in a responsible way and DCNR did a good job educating people.

The most common criticism was that stakeholders felt the decision was already made by the time they were involved. This sentiment was also expressed in the DCNR manager interviews. Part of this is due to the ATV Pilot’s creation being the result of the legislative mandate—groups that were against the whole project felt they had not been consulted on that. Another possible reason for this sentiment is that DCNR managers preemptively did a lot of the planning before involving stakeholders to increase the efficiency of their process and because they felt they could anticipate stakeholder concerns. However, DCNR managers did adapt their proposed route as they came across specific concerns. Other feedback was for earlier information and earlier involvement, which echoes DCNR’s wish to have more time to plan and engage stakeholders. This feedback came from a variety of groups, including environmental, county, and township. Stakeholders also reported wanting more engagement opportunities. Specifically mentioned were having more broadly advertised public hearings

or forums, finding ways to keep groups engaged, allowing comment on the general assembly report, publishing presentation slides online, and cross-communication between advisory committees. It is interesting that stakeholders asked for more public hearings and forums, but DCNR held many meetings open to the public—was the outreach for these meetings sufficient? Stakeholders also wanted more outreach from DCNR—specifically mentioned suggestions were to publish in newspapers and outdoor publications, provide statewide press releases about plans and stakeholder engagement opportunities, and target outreach toward local environmental and recreation groups. Two stakeholders also expressed stakeholder fatigue and desired higher-quality forms of engagement. One stakeholder wanted more dialogue and felt like DCNR controlled the agenda and conversations at the meetings—this was exacerbated by having some of the public meetings changed to virtual, which did not allow adequate time or space for dialogue. Another stakeholder felt that the public surveys had limited options and underlying biases (Stakeholder Interview, 2024; DCNR Manager Interview, 2023).

In relation to the legislative mandate, seven stakeholders reported they felt DCNR had no choice over whether to do the ATV Pilot. One stakeholder felt DCNR should have said no or made the process more problematic (Stakeholder Interview, 2024).

In addition to evaluating their participation, stakeholders were also asked about their thoughts on regional authority over the ATV Pilot. Comments were equally positive and negative, with one neutral response. Positive comments were that it would help coordinate the multiple jurisdictions, it would help provide representation for stakeholders, and that it makes sense. Negative comments were that it might put additional pressure and authority over state forest lands and concerns about funding. One stakeholder stated that the need for it indicates that the ATV Connector is a problem and not sustainable. Another stakeholder predicted that it would not work well because of infighting, no one wanting to take responsibility, and competing priorities (Stakeholder Interview, 2024).

Chapter 5. Discussion and Recommendations

I. Stakeholder Perspectives

The ATV Pilot is an example of DCNR managing competing interests and power dynamics at all levels—from the general public to the General Assembly. Figure 9 summarizes four different stakeholder perspectives that were observed during this study. There are overlapping viewpoints between the different groups. DCNR is in the middle trying to find a balance and make everyone happy. While not ending in complete agreement, stakeholder involvement can help bridge the gaps between these perspectives and develop a mutual understanding.

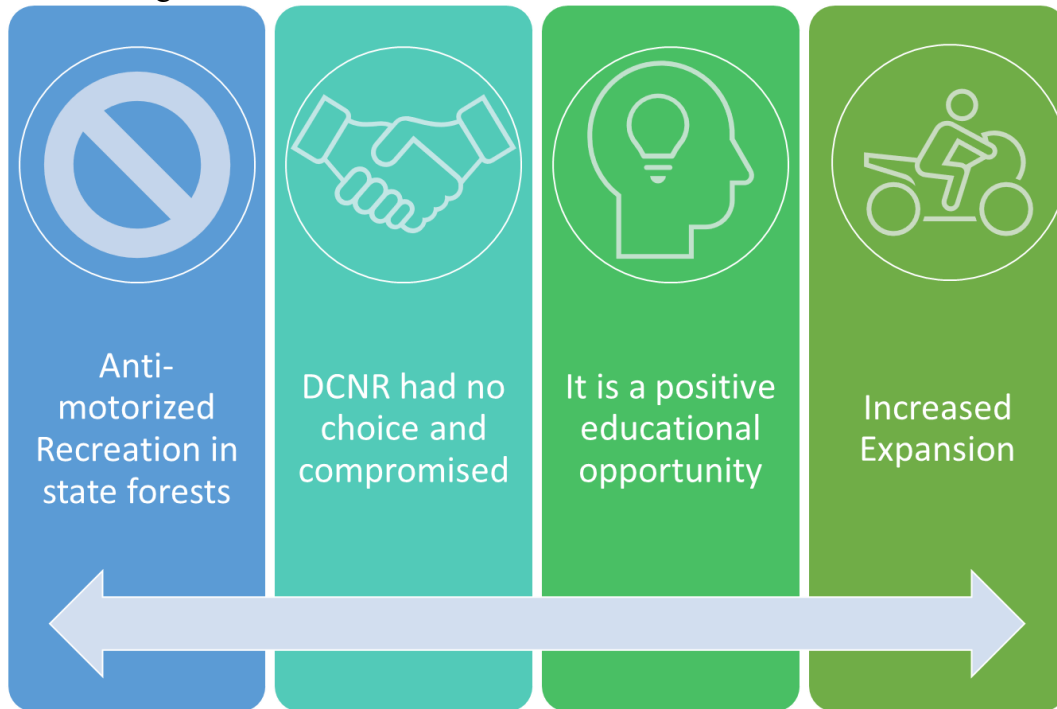


Figure 8: Stakeholder perspectives - formulated from an analysis of stakeholder interviews.

A. Anti-motorized recreation

The anti-motorized recreation perspective believes that ATVs (and in some cases, snowmobiles) do not belong on public land. They believe that it is incompatible with the values of the state forest due to the high impact. They view motorized recreation as another form of extraction in the region, which has followed colonization, the timber clearcutting in the early 1900s, and the gas extraction in the early 2000s. They view the economic benefits as short-term economics, lacking long-term vision and sustainability. These groups value low-impact recreation and use and preserving the environment. They believe that it is not a question of which form of recreation is better but rather of the overarching purpose of state forests—conservation and preservation should take priority over high-impact recreation. Despite DCNR’s efforts to avoid creating new trails and minimize the amount of state forest open to ATV riding, they fear that bringing more ATVs to the area will result in increased illegal usage and damage to state forest land, as well as private property. The lack of

enforcement exacerbates this. Once the damage is done, especially in a sensitive area like a wetland, it is costly or irreparable. These groups believe that DCNR had no choice in the ATV Pilot and feel that it was wrong for the General Assembly to mandate the ATV Pilot. They bring environmental concerns to the attention of DCNR and the public and provide representation for another stakeholder—the ecosystems and all their living things—which are largely marginalized and often disempowered in today’s modern world. They are in support of the lawsuit against the General Assembly and some think DCNR should have either said no or made the process more difficult.

DCNR managers implied that these groups need a reality check, as they are “entrenched in their hate for motorized recreation that they can’t get past that to look at the reality”—“the reality” being that DCNR has been working hard to make the ATV Pilot compatible with state forest use and values. This is backed by their monitoring report, which shows there were minimal impacts on the state forest environment and users (PA DCNR, 2023d). However, the DCNR managers also express concern about the potential impacts, especially of illegal trails. They believe it is important to keep monitoring and working to prevent impacts. They also believe that the anti-ATV perspective is important to keep everyone in check (DCNR Manager Interview). Their viewpoint is necessary to provide pressure to balance against those promoting ATV use.

B. DCNR had no choice and compromised the best they could

This perspective acknowledges the growing popularity of ATVs and UTVs as a family-friendly activity. However, they are concerned about the placement of the ATV routes. This can include residents who do not want large groups of ATVs passing their homes or recreationists concerned about the ATVs impacting their preferred activity. They believe DCNR did their best with the situation by placing the routes on existing roads, where it minimized environmental impacts and avoided areas popular for other types of recreation. This was the case, at least within the state forest. However, by doing so, a heavier impact, of having the ATVs on roads, was placed on the local residents and townships. They expressed the idea that the ATV Pilot was DCNR’s compromise and preventative measure to take control and eliminate the need to construct new trails or open additional state forest roads. Some also expressed that giving ATVs a place to ride would decrease illegal use because they would no longer feel like they need to hide. Some of the DCNR managers aligned with this perspective and discussed how, as a government body, it is a reality that politics play a part in their operations, and they need to balance the state forest resource plan with political power at times (DCNR Manager Interview, 2023; Stakeholder Interview, 2024).

C. It is a positive educational opportunity

A more positive perspective is that the ATV Pilot is beneficial, provided there is careful monitoring and education. This perspective believes that including ATV riders would connect more people with nature and conservation. This group also believes that ATV riders will become more organized so that they can teach and promote riding ethics. While ATV riders initially had a bad reputation, the ATV Pilot gave them the chance to prove themselves and foster an educational culture. This perspective feels that illegal riding will be reduced by providing these additional riding opportunities. Additionally, the economic benefits will help the local communities, who once relied on snowmobiling but are now suffering from warmer winters.

D. Increased Expansion – Supply and Demand

The final perspective suggests that state forests belong to the public and should be responsive to the needs of the public. This perspective believes in the potential for growth in popularity and economic potential within the sport of ATV riding. Therefore, they believe there needs to be more riding opportunities. Since there is a demand for longer-distance riding opportunities, they believe more trails will help meet the demand. They also want to eventually get off the roads and onto trails because this presents more challenging and adventurous opportunities. This perspective views opposition as an individual preference favoring one form of recreation over another—people who are opposed to ATV expansion just don't like ATVs or seem to think their sport is better. Recreation should be provided for all with increased access across the state, and this should apply to motorized recreation too.

II. Recommendations for DCNR

Two of the four perspectives represent “extremes” at either end of the spectrum, with the middle two representing what DCNR says they had a choice in. DCNR's biggest constraint was the legislative mandate, which impacted their timeframe and created management constraints. This affected their ability to engage all groups of stakeholders in a fully meaningful way.

The discussion below uses Luyet et al.'s (2012) framework to recognize what worked well and what areas were problematic for DCNR's stakeholder involvement process. The legislative mandate and the associated time constraint created a bias in the project because it assumed that the ATV Pilot was the correct thing to do. By removing this debate, the General Assembly bypassed entire groups of stakeholders. Since the decision on whether to have an ATV Pilot was already made, DCNR had to focus on *how* to implement the ATV Pilot. These recommendations toward DCNR are therefore directed at how they can improve stakeholder engagement within the constraints of the project.

A. Identify more of the local groups that are directly impacted:

Due to the limited amount of time, DCNR identified their initial stakeholders based on how important they were in implementing the ATV Pilot. They also identified the other stakeholder interests in the project and anticipated their recommendations and concerns in the initial planning. These groups were involved at a later point once they were sure the ATV Pilot was feasible.

Based on the results of the study, DCNR identified all the main stakeholder interests, but not all the groups. In some instances, groups had to approach DCNR to become involved. One area of improvement would be identifying more of the local groups that are directly affected, such as local recreation groups and local environmental groups. Also, consulting with stakeholder groups on what other groups to include can help eliminate bias from the managers (Luyet et al., 2012). This is especially important when non-local managers are involving stakeholders—they are not as familiar with the area and should consult local groups for recommendations on who else to involve.

B. Inform and involve stakeholders earlier to prevent loss of trust:

DCNR characterized stakeholders by their level of power—whether they had the authority to help make the pilot happen. Groups without authority were involved later or accessed through representative structures (ie: local government). Stakeholders from these groups

without authority expressed they felt the decision had already been made by the time of their involvement, which reflects a loss of trust in the democratic process. Some of this is the result of DCNR playing “catch up” after having only six months to implement the ATV Pilot, rather than DCNR’s own involvement. This does not really reflect anything DCNR did wrong, but rather their way of dealing with the planning process. However, they should note that their delay in informing stakeholders resulted in a loss of trust from some groups.

Earlier involvement is recommended to help build trust, inform, and manage expectations. DCNR can be more transparent about upcoming projects, especially if they might be considered controversial. DCNR did not need to be certain the ATV Pilot was feasible before announcing it to the public. By doing this, many individuals and groups found out about it earlier through “scuttlebutt.” This led to rumors, misinformation, and loss of trust.

C. *Be intentional about stakeholder characterization, stakeholder structures, and degree of involvement early in the process.*

It is recommended that DCNR consciously characterize stakeholders through mapping and identifying links and relationships (Luyet et al., 2012). This can help ensure that a broader range of groups are represented, even when not invited to all arenas—such as on advisory committees.

The main stakeholder structures were existing seats on advisory committees and the seats on the newly created ATV Task Force. Both relied on representative structures to reach a broader range of stakeholders. Other stakeholders were involved through avenues available to the public. These methods were efficient and helped reach a broad range of stakeholder types. Both structures had degrees of involvement with a range of informative, consultative, and collaborative. Meanwhile, other groups and the public were involved but mostly by their own initiative. Their degree of involvement was usually informative, but also consultative in cases with specific routing concerns. At times, DCNR was clear about stakeholders’ degree of influence—many stakeholders were aware of DCNR’s constraints. This helped foster understanding with stakeholders that were not fully in support of the ATV Pilot. In one case, stakeholders, who were initially wary due to the contentious nature of the project, were very appreciative that DCNR reached out directly to their group leaders and explained their constraints to them (Stakeholder Interview, 2024).

Luyet et al. (2012) stress the importance of intentionally planning the structures and degrees of involvement. In terms of creating structures that are specific to the project, intentionally identifying and collaborating with local champions earlier in the process can help distribute ownership of the project among stakeholders. For example, the ATV Task Force wasn’t created until June of 2021—five months after the planning process had begun and just several weeks before the ATV Pilot opened. DCNR can be more transparent and intentional about the assigned degree of involvement. While some stakeholders were aware of their role, others were still frustrated and unaware. Additional outreach and transparency about the constraints of the project, ground rules, and what type of involvement they are seeking will help build relationships with groups that are not in support.

D. Include informal, noncompetitive methods of stakeholder engagement:

Luyet et al. (2012) recommend having multiple methods of involvement for stakeholder group participation. DCNR did well to offer multiple methods of involvement that included public participation, assuming they knew about it or had access.

Careful consideration should be given to public hearings. Public hearings can be biased in that they favor those with education, time, and money, and are able to navigate bureaucracy (Krupa et al., 2019). This can result in larger, more organized stakeholder groups being favored over the smaller, specialized, and localized groups who are potentially impacted more. Public hearings can also polarize opinions (Fiorino, 1990). One recommendation is to include more informal methods of involvement, in a non-competitive environment, where stakeholders from different groups could engage in dialogue with one another. This can help break down the barriers between perspectives and build trust between the groups. However, the success of such methods may be limited due to the legislative mandate further polarizing groups with differing perspectives.

E. Publicize appropriately to the intended audience and be clear about the purpose of the participation method:

Luyet et al. (2012) recommend publicizing appropriately to the intended audience and being transparent about the participation process. While DCNR had many meetings open to the public, it is unclear how well they reached their intended audience—or who their intended audience was. Stakeholder groups were not always aware of the public meetings but also may not have been a prioritized group.

Recommendations are to make sure groups are aware of the methods of involvement—especially methods of involvement targeting their groups. All identified stakeholder groups should be targeted in several methods of involvement (Luyet et al., 2012). For example, if an environmental group attends a public township meeting, where they are not the intended audience, they could feel excluded or have their interests outnumbered. Having a meeting specific to certain types of groups would help. If that happens to be an advisory committee meeting that is open to the public, make sure other groups of the same interest as the advisory committee are invited. Alternatively, it is also beneficial to have cross-communication between structures to prevent silos. Therefore, it is important to be clear about the intention of each method of participation—whether it is to understand the stakeholder interests of one type of group better or to encourage dialogue between groups.

F. Provide access to resources throughout the process:

Throughout the process, DCNR should provide access to resources. Information about the method of participation, resources about the content, and expectations for participants should be provided beforehand. When possible, avoid changing the format of a participation technique after it has already been broadcast, such as changing a meeting from in-person to virtual. Afterward, provide public notes or copies of slides for those who were unable to attend. Make sure all intended groups have access to public surveys and be clear if the results are disproportionately skewed towards one stakeholder group's interest. To maximize the quality of stakeholder feedback, provide agendas that are not rigid and allow space for meaningful dialogue, education, and different opinions.

G. Evaluate and adapt stakeholder engagement processes:

According to Luyet et al. (2012), evaluation is important for improving future practices and understanding the impacts on stakeholders. DCNR did not conduct a formal evaluation of its stakeholder involvement process and does not have an established process for evaluation. In the future, they should implement criteria for how to evaluate stakeholder involvement, collect data from the stakeholders throughout the process, and discuss how to improve in the future. Having an established process will help make stakeholder evaluation more efficient. At the very least, managers and district foresters should meet to discuss what they think worked well and what could be improved. Stakeholder evaluation can help build relationships with all types of groups.

H. Other considerations

Evaluate and consider whether there is a gap between DCNR senior management and the lower tiers. It was reported that DCNR senior management was able to steer the legislative mandate to an extent; however, it is unclear how much influence they had. If district-level managers were consulted, would the constraints of the legislative mandate have been as restrictive? How much weight should be given to district managers', regional managers', and specialists' expertise? These were the managers and staff whose entire job duties were changed overnight when the legislative mandate passed, yet many were not consulted beforehand. This lack of transparency led to timing and logistical constraints that could have been addressed had the district foresters and other staff been consulted before the legislative mandate. It ultimately led to several district foresters retiring early (Stakeholder Interview, 2024). Also, it demonstrates a top-down approach on multiple levels because the legislators communicated with DCNR senior management and expected the orders to trickle down. Such a top-down approach is, by nature, contrary to stakeholder engagement. Having stakeholder engagement as part of a formality, embedded within a top-down process, is more harmful than not having it at all. Managers and legislators need to decide that if they truly want to have stakeholder engagement, they will need to trust the process, build long-term trusting relationships, and embrace local knowledge and expertise.

III. Recommendations for the PA General Assembly

When asked what DCNR can improve, many of the comments from both DCNR managers and stakeholders were a result of the legislative mandate. This indicates that a legislative mandate was the wrong way to approach a project such as the ATV Pilot. DCNR was overwhelmed with constraints to its authority and time limitations, and the legislative mandate prevented any further meaningful stakeholder engagement.

The results of this study indicate that the way the ATV Pilot was legislatively mandated has resulted in a loss of trust, in both the PA General Assembly and DCNR, from stakeholder groups. Reed (2008) warns against having stakeholder involvement—as was mandated by the General Assembly—for the sake of formality, without any clear goal, or taking place after a decision has already been made. Such a loss of trust can lead to future issues, as differing stakeholder interests are further polarized. Bypassing the public and numerous stakeholder groups by adding a line item to an omnibus bill at the end of a day on a Friday, by way of a virtual meeting, under growing pressure to provide funding for COVID-19 relief, where the governor can only fully deny or approve all items, hardly seems democratic.

The initial grassroots efforts by ATV clubs to build an ATV connector continually failed due to numerous concerns by stakeholders and violations of government policies. This can be interpreted as the government policies being outdated, and/or as a sign that such a project is not sustainable or acceptable to the public. It may be true that the least satisfied voices are the loudest, and it is possible that the project is accepted by the majority of those affected—however, this is not indicated by the monitoring report (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023). The results of this study suggest that the way the ATV Pilot was mandated has resulted in a loss of trust from stakeholder groups.

Institutionalizing stakeholder involvement without addressing equity can result in strengthening privileges and inhibiting marginalized opinions (Krupa et al., 2019). This was done when the mandate required stakeholder involvement under conditions that strengthened the privileges of certain groups. The legislative mandate favored the ATV pilot partially due to its “promised” economic impact. This suggests that the ATV Pilot favors a privileged group that has money at their disposal for an expensive form of recreation. This does not promote diversity and equity within outdoor recreation and does not bring underprivileged groups to parts of state forests that they historically were not able to access due to limited resources. Additionally, the environmental and some recreation groups’ concerns were inhibited in the decision to mandate the ATV Pilot because their groups do not have political lobbying power or economic promise. The ATV Pilot comes at great cost to the residents living along the route, especially those who were attracted to the region for peace and quiet.

An overarching recommendation for the General Assembly would be to not use a legislative mandate to implement such projects. Large, landscape-level projects, with a wide array of stakeholder interests and unaddressed concerns, should result from thorough and long-term stakeholder engagement and be informed through local knowledge and expertise.

IV. Recommendations for Stakeholders

Stakeholder groups, regardless of their interests, can help increase their involvement in several ways. They can organize and unify their interest by forming coalitions with multiple groups. They can provide outreach to nonmembers with similar interests. This will help access more members of the public. Stakeholder groups can work on building a relationship with their district forester—groups that had a relationship with their district forester felt they had better access to information and more of a voice. Similarly, stakeholder groups that are not represented on an advisory committee or council should try to use their network to build a relationship with a member of one of these committees. This will help promote awareness about their meetings when they are open to the public. Stakeholders who have lost trust can continue to voice their concerns because there may be flexibility in *how* such projects are implemented. Finally, stakeholders can try to follow legislative activity by subscribing to legislative alerts, although this can be challenging because there is so much to filter through.

V. Conclusion

This study has documented and evaluated how stakeholders were engaged in the formation of DCNR’s ATV Pilot. While many of the results are specific to the ATV Pilot, the ways in which stakeholders were engaged, and their concerns can be applicable to other ATV trail systems that are being developed. While managers may be aware of the broad array of stakeholder interests, it is important to engage with them to gain their local insight, build

trusting relationships, and try to bridge differences between differing stakeholder perspectives.

Future research can focus on mapping stakeholder interests and quantifying their involvement and influence. How does stakeholder engagement relate to their satisfaction with the project and their views on other stakeholder interests? In addition to the planned continued monitoring of the ATV Pilot, future monitoring should document a broader array of the environmental impacts, including areas outside of the state forest; breaches of enforcement and the impacts on safety, property damage, and the environment; and a robust perspective of how residents are impacted.

The results of this study suggest that the broad array of social, economic, and environmental interests behind outdoor recreation present valuable perspectives that are necessary to achieve a balance. As outdoor recreation in general is growing, it is gaining political and economic power. The promise of economic benefit to communities and the ways it connects people to nature incentivizes keeping areas forested. DCNR has been moving fast to promote and develop outdoor recreation due to funding opportunities (Commonwealth of Pennsylvania Office of the Governor, 2023). However, outdoor recreation in general must be balanced with social and ecological sustainability, as well as the other uses of forests. Moving forward, managers and stakeholders must work together to carefully develop, monitor, and adapt a model for sustainable recreation. Such a model for sustainable recreation can be used to improve existing outdoor recreation opportunities and guide future outdoor recreation projects.

Appendix A: The Local Economic Impact of DCNR's ATV Regional Connector Pilot on Potter and Tioga Counties During the 2022 and 2023 Riding Seasons

By Lisa du Preez, Timothy Kelsey, Michael Jacobson

I. Introduction

Pennsylvania Department of Conservation and Natural Resources (DCNR) ATV Regional Connector Pilot was established with the hope of attracting visitors from outside Potter and Tioga County for multiple days and providing economic opportunities to the local businesses in that region. This report examines the economic impact of the ATV pilot on Potter and Tioga Counties during 2022 and 2023, the pilot's first two years of operation.

II. Methodology

The *economic impact* is the overall effect of new dollars spent by visitors from outside the region who came to the counties to use the ATV pilot. These new dollars and subsequent spending in the counties would not have occurred if the ATV pilot had not existed. In this study, the region consists of Potter and Tioga Counties because they contained most of the ATV Pilot during the 2022-2023 period.

Visitor spending data associated with the ATV pilot was collected by an email-based survey to ATV pilot permit holders who live outside Potter and Tioga Counties. These permit holders were identified by zip code and were randomly selected each month of the riding season for the two-year study. In 2022, a total of 3,650 permits were sold, including 3,205 from outside Potter and Tioga Counties (87.8%). In 2023, a total of 5,255 permits were sold, and 4,682 of these were from outside Potter and Tioga Counties (89%). The survey consisted of questions about number of visits, group size, length of visits, and expenditures at various types of businesses.

The visitor spending data was analyzed using the economic model IMPLAN, which is an economic impact model commonly used to estimate the economic impact of events, new businesses, and other changes (Hardy & Kelsey, 2013). IMPLAN estimates the total economic impact of an event, including direct, indirect, and induced effects. Unlike an estimate of original expenditures (*direct effects*), the economic impact also looks at the indirect and induced effects on gross sales and income as the money recirculates through the economy. *Indirect effects* are the spending made by the original industries in the local economy, because of additional profits. For example, a visitor's direct spending at a local restaurant will result in indirect economic effects as the restaurant purchases more materials to make more food, such as from a local grocery store or local wholesale provider. *Induced effects* are the impacts resulting from added local spending by employees of these businesses, such as employees spending more locally due to their earnings indirectly related to the ATV pilot. IMPLAN software uses multipliers calculated for the specified region based on the local resources and industries that are available.

III. Results

A. Survey Results

Table 8 displays the estimated total spending associated with the ATV pilot in Potter and Tioga Counties by non-local visitors during the 2022 and 2023 ATV pilot riding seasons. The most money was spent on restaurants and meals, with an estimated \$2,210,471 in 2022 and \$3,691,295 in 2023 respectively. This was followed by total lodging, which was \$1,985,788 in 2022 and \$3,092,557 in 2023. Gasoline and auto-related services were the next highest expenditure of non-local visitors, at \$1,982,942 in 2022 and \$2,726,504 in 2023.

The biggest difference in spending between the two years was a decrease in ATV equipment, supplies, and services and an increase in ATV rentals. This is likely because more people were buying new ATVs in 2022 and did not need to buy them again in 2023. The expenses in 2022 were much higher, and several survey results showed expenses equaling the approximate price of new ATVs. Also, in 2023, one of the ATV dealerships in the region had its inventory sold and put its property for sale. In 2023, a campground close to the border of Clinton and Potter County started offering ATV rentals, as a result of the ATV pilot. While this campground is in Clinton County, it is possible some of the survey participants thought it was in Potter County.

Table 5: Estimated total spending in Potter and Tioga Counties from ATV pilot participants, as a result of the ATV Pilot during the 2022 and 2023 riding seasons.

Spending Type	Estimated total spending	
	2022	2023
Lodging (total)	\$ 1,985,788	\$ 3,092,557
Hotels or motels	\$ 342,481	\$ 665,729
Campgrounds (private and state)	\$ 738,977	\$ 957,261
AirBNB or Bed and Breakfast	\$ 595,814	\$ 1,079,098
Other lodging	\$ 308,517	\$ 390,469
Restaurants/meals	\$ 2,210,471	\$ 3,691,295
Food & beverages from a store	\$ 1,086,251	\$ 1,886,472
Gas & auto services	\$ 1,982,942	\$ 2,726,504
ATV rental	\$ 12,281	\$ 122,994
ATV equipment, supplies, services	\$ 2,396,086	\$ 618,761
Other spending	\$ 788,314	\$ 973,447
Total	\$ 10,462,133	\$ 13,112,029
<i>*Numbers are expressed in August 2023 dollars.</i>		

The estimated total spent in Potter and Tioga Counties by non-local visitors to the counties due to the ATV pilot was \$10,462,133 in 2022 and \$13,112,029 in 2023. However, these numbers do not account for how much spending remained in the local economy and do not include the indirect and induced effects on Potter and Tioga Counties. These total spending estimates were added to IMPLAN by sector to calculate the economic impact.

B. Economic Impact Results

The IMPLAN software estimated a total economic impact of \$8,249,002 in 2022 and \$11,739,639 in 2023 (Table 9). The total economic impact can be interpreted as money added to Potter and Tioga Counties, which would not be spent if the ATV pilot were not in existence. The economic impact is less than the total spent because some of the money did not remain in the local economy (“leakage”), such as money spent on ATV equipment or non-locally produced items. However, both years saw indirect and induced effects between \$1.2 million and \$2.6 million. The induced effects were likely higher than the indirect effects because they capture money spent on Airbnb, which goes directly to the households rather than an official business.

Table 6: Estimated total economic impact of the ATV Pilot in Potter and Tioga Counties expressed in total sales.

Potter and Tioga Counties, all sectors	Year	Direct	Indirect	Induced	Total
	2022	\$ 5,185,485	\$ 1,282,474	\$ 1,781,044	\$ 8,249,002
	2023	\$ 7,307,548	\$ 1,815,436	\$ 2,616,655	\$ 11,739,639

**Numbers are expressed in August 2023 dollars. Data generated with IMPLAN software*

Similarly, Table 10 shows the estimated number of jobs associated with the ATV pilot. A total of 100 full-time equivalent jobs were supported by the pilot in 2022 and 145 in 2023. This includes 7.8 and 11 jobs supported in other businesses in the counties due to indirect effects in 2022 and 2023, respectively, and 12.9 and 18.9 jobs supported by increased spending by local households earning more due to the ATV pilot in 2022 and 2023 respectively.

Table 7: Estimated total economic impact of the ATV Pilot in Potter and Tioga Counties expressed in added employment.

Potter and Tioga Counties, all sectors	Year	Direct	Indirect	Induced	Total
	2022	79.5	7.8	12.9	100.2
	2023	115.8	11.0	18.9	145.7

**Full time equivalent jobs*

Table 11 shows the top sectors impacted by the ATV pilot. As seen in the total expenditures reported in the survey, restaurants in Potter and Tioga Counties saw the greatest increase in revenue and jobs in both years—63 jobs and \$3.7 million in 2023. That is 43% of the estimated added jobs and 32% of the added revenue. The second most popular sector was “other lodging,” which includes private campgrounds and bed and breakfasts. Though lower in total number of jobs and revenue, hotels and motels saw the greatest percentage increase (94%) from 2022 to 2023. Food and beverage stores also saw a significant increase (72%).

Table 8: Estimated economic impact of the ATV Pilot in Potter and Tioga Counties by top seven sectors.

Sectors	2022			2023		
	Jobs	Revenue	% Total Revenue	Jobs	Revenue	% Total Revenue
Total	100.2	\$ 8,249,002		145.7	\$ 11,739,639	
Restaurants	37.6	\$ 2,257,096	7.2%	62.6	\$ 3,759,952	12.1%
Private Campgrounds, Bed and Breakfast, and Other Lodging	12.0	\$ 741,347	17.8%	14.8	\$ 908,095	21.8%
Misc stores	11.4	\$ 457,024	2.9%	14.1	\$ 569,188	3.6%
Food and beverage stores	6.2	\$ 391,987	1.6%	10.6	\$ 672,969	2.8%
ATV rental, equipment, and dealerships	5.4	\$ 638,072	3.0%	1.9	\$ 223,986	1.1%
Gas stations	4.8	\$ 451,193	1.7%	6.6	\$ 621,571	2.4%
Hotels and Motels	4.0	\$ 342,485	2.7%	7.9	\$ 665,734	5.3%

**Revenue is expressed in 2023 dollars and jobs are full time equivalent. The numbers depicted here do not add up to the total because other sectors are impacted that are not shown. Data is from IMPLAN, Copyright 2023 Minnesota IMPLAN Group, INC.*

To put these numbers into perspective, the “% Total Revenue” column of Table 11 shows the percentage of the total revenue for each sector. For example, the 2023 revenue from the ATV pilot is 21.8% of the estimated total revenue for private campgrounds, bed and breakfasts, and other lodging. The ATV pilot also provided 12.1% of the restaurants’ total revenue in 2023. This is significant, considering the ATV trail is only open for four months out of the year (Minnesota IMPLAN Group, INC., 2023).

IV. Impact Summary

In conclusion, the ATV pilot has shown a promising economic impact on Potter and Tioga Counties in 2022 and 2023. This study is only an estimate and depends on individual spending and whether businesses truly recirculate their money within the local economy. Since the estimated total spending is based on self-reported expenditures, there is a chance the numbers are inflated. Similarly, this study cannot be used to predict the future success of the event and only shows the event’s impact on the local economy at the time that the study was conducted.

In order to understand the full economic impacts, a cost-benefit analysis must be conducted, which includes the costs of maintenance, deferred costs, and opportunity costs, as well as who is paying the costs and who is gaining the benefits. Some of the costs during the ATV Pilot period are documented in DCNR’s report to the General Assembly (DCNR, Report to the General Assembly on the Northcentral ATV Regional Trail Connector Pilot, 2023), but long-term costs and benefits need to continue to be monitored.

For future studies, it will also be useful to look at how the ATV Connector, and tourism in general, contributes to the conversion of residences to short-term rentals and its impact on communities.

Appendix B: Water-Energy-Food-Ecosystem Nexus: Projects from the Umgeni River Catchment in South Africa (INTAD Component)

I. Introduction

The water-energy-food-ecosystem (WEFE) nexus studies the interlinkages of WEFE to promote synergies and identify tradeoffs between the sectors rather than isolating the individual sectors (Teutschbein, et al., 2023). Within the context of social change and development, it is also important to consider the impact of WEFE projects on communities and livelihoods. Seers defines “development” as subjective but improving on unemployment, poverty, and inequality (1979).

This chapter starts with a review of the Umgeni Catchment and its WEFE resources and challenges. Then, two qualitative case studies of WEFE nexus projects are described, highlighting the interactions between WEFE resources. This follows with a discussion of how the projects fit within a historical framework, whether they constitute development and their resilience and scalability in the long term. The chapter concludes with recommendations for future work.

II. Description of the Study Area

The Umgeni Catchment (also written as Mgeni or uMgeni) is in KwaZulu-Natal (KZN) Province in eastern South Africa. The catchment covers approximately 4,432 km², and the Umgeni River is 232 km long (Banda & Kumarasamy, 2020). It originates at 1,760m above sea level at the Umgeni Vlei Nature Reserve in the foothills of the Drakensberg Escarpment, flows through Pietermaritzburg, and enters the Indian Ocean just north of Durban. In the upper and midlands of the Umgeni Catchment, economies are centered around agriculture, grazing pastures for livestock, and forestry plantations. The lower parts of the catchment in Pietermaritzburg and Durban have sectors in sugarcane, manufacturing, and trade, but also feature a growing informal economy (South African River Health Program, c. 2002).

III. Overview of WEFE Resources and Challenges

A. Water

The Umgeni River is an important source of water for about 6 million people, including the cities of Pietermaritzburg and Durban (Institute for Environmental Systems Research STEER, 2017). The waters of the Umgeni Catchment are heavily regulated by large dams, weirs, and smaller farm dams that capture water for irrigation, domestic use, industry, forestry, dryland agriculture, tourism, and recreation. There are approximately 300 farm dams within the middle and upper reaches of the catchment, supplying water for 185 km² of irrigation. Other uses of water include fishing, sand mining, cultural and spiritual activities (Banda & Kumarasamy, 2020).

Nationwide, approximately 93.9% of households have access to drinking water (WEF nexus index, South Africa, 2022). However, this varies greatly across the country and within the Umgeni Catchment. As shown in Table 12, access to indoor water varies between 18.1% and 76.4% among municipalities in the Umgeni Catchment. Plumbing connected to a sewer also varies between 15.8% and 83%. The Umgeni Catchment is water-stressed, and at times, the water use exceeds water supply, depending on the annual rainfall (Umgeni-uThukela Water, 2021).

Table 9: Household statistics for municipalities in the Umgeni Catchment with upper and lower ends of the ranges highlighted. Sources: Unemployment, household, and agricultural data (KwaZulu-Natal Census, 2011); all other data (KwaZulu-Natal Census, 20

Municipality	Unemployment	Electricity	Indoor water	Toilet connected to sewer	Weekly garbage removal	Involved in household agricultural activities	Total population
Impendle	45.1%	97.0%	18.1%	15.8%	11.8%	56.4%	36,648
uMgeni	23.9%	94.4%	76.4%	83.0%	80.0%	22.2%	105,069
Msunduzi	33.0%	98.0%	54.5%	63.0%	56.6%	21.7%	817,725
uMshwathi	24.9%	95.0%	29.4%	32.1%	28.1%	33.2%	118,478
eThekwini	30.2%	98.5%	69.8%	80.4%	80.7%	11.0%	4,239,901
Mkhambathini	26.8%	96.3%	23.8%	25.3%	15.7%	33.9%	61,660
Mpofana	23.9%	95.7%	59.9%	80.2%	74.4%	31.2%	33,382
Richmond	26.3%	97.8%	24.0%	22.7%	26.7%	34.2%	62,754
Weighted average	30.4%	98.2%	65.3%	75.1%	74.1%	14.3%	

In the upper portion of the catchment, agriculture causes nutrient pollution in rivers and dams, resulting in eutrophication and algal blooms. Invasive alien plants (IAPs) reduce the flow of water to the river and increase erosion. Forestry plantations reduce water availability and require water licenses as well as regulations for how close the plantation trees can grow to rivers and streams. Further downstream, urban sprawl and industrial effluents cause more degradation and pollution. Pietermaritzburg and Durban have inadequate infrastructure for waste and drinking water. These areas also experience illegal water extraction and illegal sand mining due to social inequities. Littering is severe especially in urban Pietermaritzburg and Durban, causing blockage of waste and stormwater pipelines that result in overflows and flash flooding. As shown in Table 12, 74.1% of the catchment has access to weekly garbage removal, with a high of only 80.7% in eThekwini (Durban)—the municipality with the densest population (South African River Health Program, c. 2002; Institute for Environmental Systems Research STEER, 2017).

B. Energy

Nationwide, 84.4% of the population has access to electricity (WEF nexus index, South Africa, 2022), with load-shedding being a regular occurrence. In the Umgeni Catchment, 98.2% have access to electricity, which is an almost 20% increase from 2011 census data (Table 12). Other forms of energy used by households are biomass, generators, batteries, solar, and fuelwood. Fuelwood is used by 96% of rural households and 69% of low-income urban households for cooking and heating (Shackleton, Sinasson, Adeyemi, & Martins, 2022).

C. Food

Approximately 6.5% of households are undernourished nationwide (WEF nexus index, South Africa, 2022). Within the Umgeni Catchment, the major agricultural production systems include dairy, livestock, potato, and sugarcane (Institute for Environmental Systems Research STEER, 2017). Subsistence farming and fishing is an important source of food for the lower income and informal communities. As shown in Table 12, 14.3% of the population in the Umgeni Catchment is involved in household agricultural activity. The highest percentage in the catchment (56.4%) is in Impendle municipality, which also has the highest unemployment rate (45.1%). Impendle municipality is in the rural upper catchment, near the source of the Umgeni River.

D. Ecosystem

The natural ecosystem consists of high-altitude grasslands, indigenous Podocarpus forest in the mist belt, lower-altitude grasslands, and coastal mangrove forests. Naturally occurring forests are uncommon in South Africa due to lack of rainfall, fire ecology, and herbivory. Grasslands and shrublands are dominant and adapted to frequent fire regimes. Most of the natural forests are sheltered from regular fire on the cool moist southern-facing slopes, and they comprise less than 0.25-0.56% of the landscape in South Africa. KZN province has about a sixth of South Africa's indigenous forests (Harriet, Lawes, & Piper, 1999). Indigenous mist belt forests are estimated to cover about 4% of the KZN province. As of 2002, only 0.45% of these indigenous mist belt forests are protected.

The Umgeni River is known for the scaley yellowfish (*Labeobarbus natalensis*), which is endemic to the KZN province. It is a popular species for fishing and helps bring recreation to the natural areas of the Umgeni River. The river also has a stocked trout population that draws fly-fishing recreationists.

Ecosystems and natural areas suffer from fragmentation, and it is recommended to create corridors of connectivity to preserve species richness. Between 2005 and 2011, the catchment lost 7.6% of its natural land due to conversion for agriculture, timber plantations, development, dams, and mines, with a total historic loss of 48% (Hughes, de Winnaar, Schulze, Mander, & Jewitt, 2018; Rivers-Moore, Granger, Ahmed, & Cowling, 2003). The grasslands in the lower parts of the catchment are impacted by overgrazing (Hughes, de Winnaar, Schulze, Mander, & Jewitt, 2018).

E. Forestry

Due to the lack of naturally forested areas, non-native timber trees have been grown in plantations, starting in the late 19th century, to provide wood products. In South Africa, plantation forestry contributes 2% to the GDP and employs over 100,000 people (Le Maitre, et al., 2002). Commercial plantations cover about 26.25% of the Umgeni Catchment (Table 13). The dominant commercial plantation species in the Umgeni Catchment are *Eucalyptus grandis*, *Pinus patula*, and *Acacia mearnsii* (Hughes, de Winnaar, Schulze, Mander, & Jewitt, 2018).

Table 10: Landcover in the Umgeni Catchment as of 2011. Source: (Namugize, Jewitt, & Graham, 2018)

Land cover	Percentage
Natural	42.23%
Cultivated	17.11%
Plantations	26.25%
Urban/built up	5.53%
Waterbodies	3.78%
Wetlands	2.20%
Degraded	2.88%
Mines/quarries	0.02%

These commercial plantation species have been found to be invasive to the detriment of the waterways and natural forests. For example, *Acacia mearnsii* (Figure 10), also known as black wattle, is from Australia and has many commercial uses including its tannin, wood for fuel, gum, and fibrous bark (Moyo & Fatunbi, 2010). However, *Acacia mearnsii* has escaped from the plantations and spread throughout the catchment, consuming large amounts of water and threatening the natural wetlands and grasslands, particularly in the higher elevations of the catchment (Institute for Environmental Systems Research STEER, 2017; Hughes, de Winnaar, Schulze, Mander, & Jewitt, 2018). It produces large amounts of seeds that can remain viable for 50 years. Its large crown produces shade that other plants cannot grow under—this reduces ground cover, dries out the top layer of soil, and leads to erosion (Hughes, de Winnaar, Schulze, Mander, & Jewitt, 2018). It also sprouts from the roots when cut down and can generate root suckers. *Pinus patula* is native to Mexico and has invaded 17,600 ha in South Africa (Nyoka, 2003). *Eucalyptus grandis* creates similar problems as *Acacia mearnsii*—it is fast-growing and requires large amounts of water.



Figure 9: Invasive *Acacia mearnsii* (black wattle) twig and leaves.

Commercial forestry plantations growing invasive trees are required to have permits (Nyoka, 2003). Also, the forestry industry recognizes IAP problems and has adopted measures to prevent further spread, including buffers between plantations and wetland areas or rivers that are up to 30m wide. These riparian zones are required to be kept clear of IAP. It is not clear how these regulations are enforced or how effective they are in preventing the spread. A government-funded IAP control program, Working for Waters, employs and trains people in removing IAP plants and creating value-added industries out of IAP products. This program strives to benefit low-income communities, especially women (Le Maitre, et al., 2002; Department of Forestry, Fisheries, and the Environment DFFE, 2022). Another potential solution is a seed-feeding weevil from Australia that can be used as a biological control in South Africa. However, it is not used in KZN due to a conflict of interest with the commercial forestry industry (Nyoka, 2003).

IV. Case Studies

After completing the review, field visits were conducted for this case study to search for and document WEF nexus practices that can be further researched. In total, 7 were documented. This paper discusses two of them—the first is in rural upper Umgeni and the second is in the outskirts of Durban in the lower part of the catchment.

A. *Upland River Conservation's Invasive Plant Removal and Grassland Restoration in the Upper Umgeni Catchment.*

Visited: July 27 and August 2, 2022

Website: <https://www.uplandrivers.com/>

Project Description

Upland River Conservation (URC) is a consulting agency that works with private farms surrounding key tributaries in the Upper Umgeni region. The consultant meets with farmers and discusses areas to be rehabilitated through the removal of invasive alien plants (IAPs) and replacement with grassland cover species such as Kikuyu grass. The projects are subsidized through funding from the Caterpillar Foundation, the World Wide Fund for Nature (WWF), Pepsi, and the local Dargle Conservancy. Money from the harvested timber also helps subsidize the farmer's costs of removal.

Currently, there is a market for the harvested timber and pulpwood, but farmers traditionally burn the brush and waste that is left behind. Burning encourages soil erosion and the regeneration of *Acacia mearnsii*, perpetuating the cycle of IAP infestations (Figure 11).



Figure 10: (left) Bare ground left after felling trees and selling timber. This farmer chose to burn most of the waste material rather than build contours. His overstocked livestock overgrazed the newly planted grass before it could become fully established. This shows how the success of URC depends on the willingness of the private farmers to cooperate with best practices rather than quick financial gain; (right) Evidence of gully erosion on the same farm.

Rather than burn, URC encourages farmers to use the harvested timber and brush to build contours to prevent erosion, since these areas are often on hilly terrain (Figure 12). Another option URC offers farmers is to chip the remaining brush and leave it onsite to provide nutrients for the seeded or transplanted grass.

URC trains subcontractors from the local Zulu communities in Dargle Valley. URC assesses their current knowledge and business skills and trains them in approaching clients, calculating costs, removing the IAPs, and marketing the harvest. This helps build relationships with farmers and provides opportunities for continuous work.

One of the challenges is incentivizing private farmers to remove IAPs along waterways for little profit or sometimes even a cost. While some of the trees can be harvested for timber, much of the vegetation currently has no economic value. Educating the farmers is important because restoring the land to productive grasslands is profitable for grazing and cattle farming. URC is currently looking for markets for the brush and waste from the IAPs to give farmers more profit (Figure 13). There is potential for a circular economy through the production of charcoal, pellets, briquettes, and biochar, but there is currently no infrastructure for this market.

WEFE analysis

URC's IAP removal and grassland restoration project has the potential to enhance synergies among WEFE resources (Figure 14). Water availability is increased, and the quality is improved due to reduced erosion and grass infiltration.

Energy resources need to be further explored: harvested trees can be used for fuelwood, but transportation, storage, and treatment costs often exceed the value of the wood. There is also potential to convert the brush to biochar or charcoal, which can reduce the need for chemical fertilizers in farming. Another possibility is to create wood pellets for fuel or electricity. Processing and markets would need to be developed to fulfill this potential, while further considering the costs and benefits. Subsidies can be given to reduce costs or grants provided for infrastructure to support these markets in low-income communities. IAP removal can be energy intensive—requiring hard labor and herbicide. Future work should find ways to reduce the energy spent on removal.

Food resources can be enhanced by improving and increasing grazing for livestock. Pigs and goats can remove certain IAP species, such as *Rubus* species and young *Acacia mearnsii* seedlings. *Eucalyptus* and *Acacia mearnsii* logs can



Figure 11: IAP clearing along the Poort tributary. *Acacia mearnsii* trees are brighter green on the left, and the indigenous forests are the darker green on the right. Trees were cut and treated with herbicide along the tributary and laid along the contours. The steep banks of this project required additional funding from NGOs because the difficult of access, and the land is not suitable for grazing.



Figure 12: Residues left after harvesting IAP timber. These can be used to build contours along the slopes. Can there be a market for this material to help pay for the treatment and incentivize farmers?

be inoculated with mushroom spores. Some IAPs can be used for food or medicine. *Acacia mearnsii* bark has medicinal properties. Research into the medicinal uses of IAPs and market opportunities can help create jobs for community members to forage seeds and fruit (which can prevent the spread) and process IAP material into more products.

Ecosystems benefit from more native biodiversity, improved soil quality, and ecotourism in the form of bird watching or fly fishing. There is also potential to reintroduce native tree species that can be managed in an agroforestry system for fruit or medicine.

Future work needs to identify indicators for each element in WEF E and quantify the tradeoffs and benefits. Incentives for restoration need to be explored, whether they are economic,

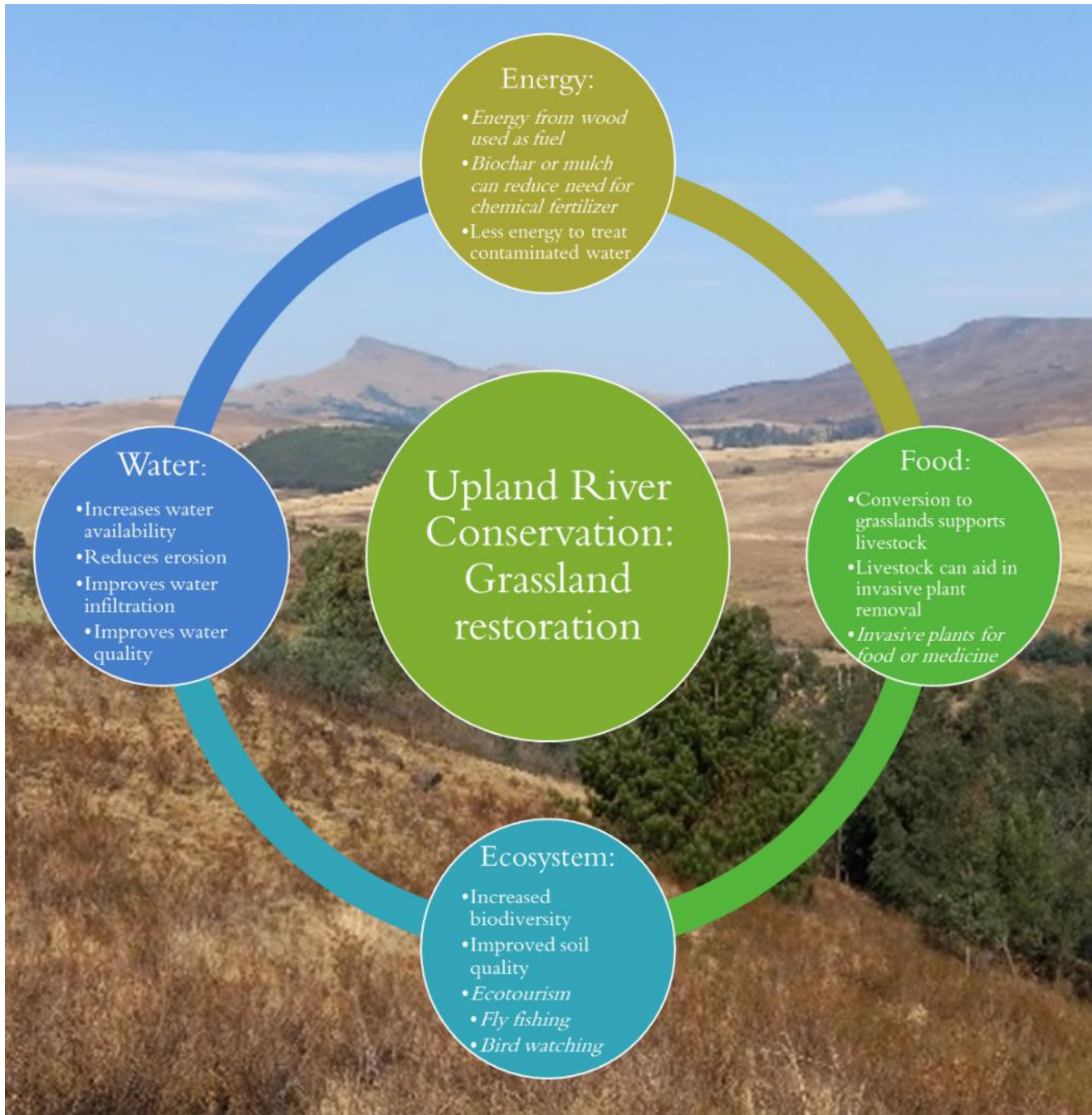


Figure 13: The IAP removal project benefits WEF E resources. Future research should focus on finding indicators and quantifying these synergies.

subsidized, or mandated. A stricter policy is needed to regulate commercial forestry production to prevent the continuous spread of IAPs, perhaps through using sterile cultivars.

While the restored land can be used for grazing, farmers must follow best practices to prevent overgrazing by using rotational grazing.

B. Buffelsdraai landfill reforestation project, eThekweni (Durban)

Visited: August 4, 2022

Project Description

The Buffelsdraai reforestation project is government-led and began in 2008 to capture carbon offsets from the cost of hosting the 2010 FIFA World Cup. It is funded through government funds and NGO's. The site is a 525-ha buffer surrounding a 120-ha landfill. Approximately 480ha was converted from a sugarcane farm, and the remaining 45ha were infested with IAPs. IAPs were cleared by mechanical methods or eco-friendly herbicides. Brooms were made and sold from some of the material. Other IAPs were used as fuelwood or building material, although this was controlled and restricted by permit. Most of the remaining dead IAP vegetation was left on site to provide biomass, habitat, and, eventually, compost.

Three-hundred-nineteen "Treepreneurs" were recruited from the surrounding low-income communities. They were educated on indigenous and invasive tree identification and trained to collect seeds from locally adapted indigenous trees in the area. They planted the seeds in recycled bottles. The process was supervised by community facilitators for quality control. Once the seedlings reached approximately 50cm in height, they were brought to the onsite nursery in exchange for vouchers for food, school fees, building materials, and other necessities. Many of the initial "Treepreneurs" were women, who seemed to have a greater interest in the project and its benefits. The onsite nursery was restored from a building existing on the previous sugarcane farm (Figure 15). Workers used wood harvested from IAPs to do the remodeling. Approximately 82,000 trees were planted in 2009. Since then, about a million trees have been planted. Currently, they are adding shrubs and understory plants to increase structural and species diversity, as well as rehabilitating wetland areas and reintroducing endangered frogs and chameleons.

Rangers were hired from the nearby low-income community and trained to prevent illegal activities in the forest, such as poaching, sand mining, and dumping. They also collect data on animals and IAP infestations. Some of the wildlife diversity that has been attracted to the area includes buck, mongoose, monkeys, and bushpigs. The project coordinators are working with local leadership to educate and raise awareness in the community to help prevent illegal activity.

Maintenance includes clearing brush, creating fire breaks, and monitoring the growth and biodiversity. There are 34 permanent workers and 47 youth interns. The management is currently looking for other markets for the seedlings grown by the "Treepreneurs" so they can continue their work once the reforestation is complete.



Figure 14: (left) The onsite nursery at Buffelsdraai; (right) In addition to seedlings grown by "Tree-preneurs," other plants are propagated from cuttings at the nursery. The blocks of this raised bed are made from recycled materials.

WEFE analysis

Since this is a government-funded project, there may be less incentive to utilize all the resources efficiently. The main objective is to capture carbon and provide a protected area for nature, rather than provide water, energy, or food. For this reason, some aspects of WEFE are not maximized, yet the ecosystem component seems to benefit the most.

Water has similar benefits to the previous project since part of the project involved removing IAPs (Figure 16). There is increased water availability through converting a water-intensive sugar cane farm and the areas degraded with IAPs to indigenous plants that are adapted to low rainfall.

Energy was provided initially when clearing the IAPs by repurposing them for fuelwood or recycling them into other materials. Using recycled materials for the planting pots and the bricks in the nursery reduced the energy for producing new products for this purpose. Expanding the project into other areas will help provide more fuelwood.

Vouchers given to the "Tree-preneurs" are used to buy food. Currently, community members are not allowed to harvest plants or fruit from the reserve for food or medicine, but this may be permitted in the future if done sustainably.

Ecosystems benefit the greatest through increased biodiversity, improved soil quality, and absorbing pollution and runoff from the landfill. The area is protected from poaching and illegal harvesting by rangers.

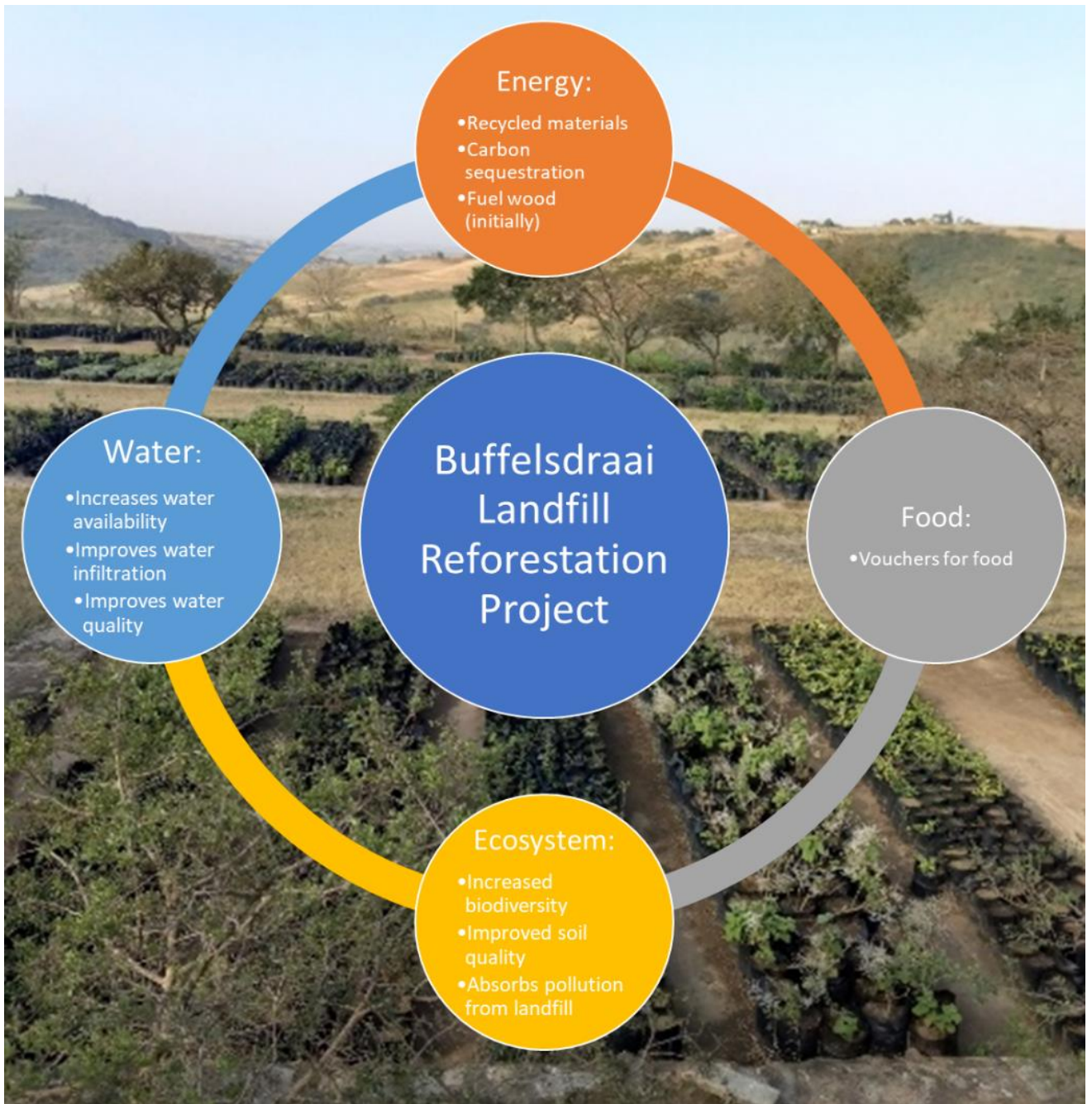


Figure 15: The Buffelsdraai Landfill Restoration Project's added benefits to WEFE resources. Future research should work to maximize the synergies.

V. Discussion

A. Historical Framework

Both projects tackle ongoing challenges that are rooted in the history of colonialism and apartheid. The forestry sector was established during the colonial era to provide timber for industrial development (Le Maitre, et al., 2002). The timber industry is now flourishing with

political influence and has an export value of about 2 billion USD in 2020 (Nyoka, 2003; Forestry South Africa, 2020). While 18.4% is nationalized, the remaining profits go to large-scale commercial or (typically white) landowners (Oberholzer, 2021). This comes at a great cost to WEFE resources and ecosystems.

URC tries to increase economic activity while solving an ecological problem and improving access to WEFE for the people in the Umgeni Catchment. The URC project deals mostly with the white landowners, who were given access to favorable land and water rights during the apartheid at the expense of the low-income black communities. These same low-income communities are now employed at low wages to do the work. The jobs benefit them and give them skills that can be translated into other trades. However, it is problematic that they are the ones cleaning up the problems created by colonialism and perpetuated resource depletion.

The Buffelsdraai landfill reforestation project was established to offset a small amount of damage that has already been done in the urban environment of Durban. The landfill and buffer were reclaimed through the purchase of a sugar plantation to provide an area to dispose of wastes from the mass consumption of capitalism. The previous ownership of the sugar plantation and the cost of purchase are unknown. The reforestation project is useful in educating the public on ecosystem restoration, but it is a small sphere within a large urban landscape—falling short of providing the connectivity required for meaningful habitats. While it was established to “offset” carbon emissions, these have already been spent elsewhere so it merely masks the underlying challenge or puts a band-aid on the problem.

B. Development?

Seers defines development as a “normative concept, almost a synonym for improvement” (1979) Specifically, he means relative improvement in terms of poverty, unemployment, and inequality.

Both programs provide low-income communities with employment. This gives them money and skills, which improves their self-reliance. Poverty and inequality are larger challenges that extend beyond the scope of these projects. Both projects help build community to an extent by utilizing local resources rather than importing the cheapest labor. The projects also teach job skills and knowledge of the environment. If these projects were scaled up, they may address poverty and inequality to some degree. Further research is needed to see how much the projects impact the communities.

In the upper Umgeni, rural communities benefit from the Upland River Conservation’s work. Here, the communities are completely isolated from markets, jobs, and resources and have poor infrastructure for transportation. According to the URC consultant, people are not raised with the expectation to work because unemployment is the norm. Basically, they lack the “modern” Westernized values of hard work, occupational and educational goals, and punctuality (Inkeles, 1969), likely because they are isolated from the markets and their benefits.

Buffelsdraai’s voucher payments limit self-reliance by controlling purchases. This has an underlying assumption that the poor do not know how to use their money. However, the voucher system can also protect the women and their families from moneylenders, thieves, or even other family members who would prefer cash. Also, the vouchers benefit local businesses.

Due to the inability to address poverty and inequality's root causes, there is a plateau in how much development can be gained from these projects. They do not challenge the underlying framework of capitalism that establishes a national bourgeois and perpetuates poverty (Cardoso, 1972). They do little to improve the infrastructure of the poor communities, which limits their ability to actively participate in the same education, markets, and opportunities that the richer communities easily have access to.

C. *Project resilience?*

The URC project relies on partial funding from donors and markets that incentivize farmers to either profit or break even from participating. What if the markets change? Developing alternative markets will improve resiliency. If the IAP removal is completely successful, then it will no longer be needed, and URC will have to move to other parts of the catchment or diversify its ecological goals.

Buffelsdraai landfill reforestation project relies on funding from non-profits and the government. It is currently very successful and is eager to show visitors its success. However, what happens if the political parties change, or funding is cut? One of the other seven case studies was on a similar reforestation project that was established during a political campaign and later abandoned (Figure 17). This was in a more isolated area, and it had negative impacts on the low-income community including disillusionment and distrust in government and aid projects.

To be successful in the long term, both projects need to be coupled with policy and economic change centered on “degrowth,” “buen vivir,” or “Ecological Swaraj.” With markets continually expanding, water, energy, food, and ecosystem resources are doomed, regardless of measures that are put in place to protect or restore them. Growth will always be demanding more. Redistribution is also important during degrowth so that the poor do not suffer from economic cutbacks (Kothari, Demaria, & Acosta, 2014).

D. *Scalability?*

The URC project scalability depends on the local markets and land usage of the areas it is expanded to. It relies on money from donors to subsidize the cost and would have to seek additional funds if expanded. An alternative project is Working for Waters—a government-funded version of URC that began in 1995 and operates across 9 provinces. However, Working for Waters does not allow landowners to profit from the trees that are harvested, so there is little incentive for landowners to get involved. Working for Waters rather focuses on low-income community land and public land. Most of the IAP material is left on site, which can cause more intense wildfires—favoring *Acacia mearnsii* propagation while damaging indigenous seed banks (Moyo & Fatunbi, 2010). Projects like URC can help work together with Working for Waters to tackle the same problem on private lands.



Figure 16: A restoration project that was abandoned along Inanda Dam. A now unemployed “Tree-preneur” is awaiting funding to continue the project. Her trees have outgrown their pots.

The Buffelsdraai landfill project requires government and donor funding without generating any profit. Therefore, the government is not capable of replicating this on a large scale due to the number of resources required. Finding other ways to fund these projects will help scale them up. It is important to plan strategically so that restored areas have connectivity. Perhaps policy can take more from large carbon emitters to help provide funding.

VI. Future research

Future research can focus on quantifying the benefits to the WEFE resources and the low-income communities. Indicators for the WEFE resources need to be identified, measured, and modeled. This will help guide recommendations for improving these projects and developing new projects. The exact costs of the projects should be analyzed and compared with the WEFE benefits in a cost-benefit comparison. The economic impact on low-income communities can be calculated by changes in employment and local spending as a result of each project.

Feasibility studies should be done to help develop new markets that will benefit low-income communities and provide funding for WEFE projects. This includes research into the effectiveness of producing biochar, wood pellets, or other forms of energy from IAP material. Also, research should be conducted on the medicinal uses of IAPs and market opportunities.

Additional studies should be done to search for local initiatives in the region and their effectiveness. A focus on WEFE in informal markets would be useful because they were not observed in this study—there is a large informal market for natural medicine (Mander, Ntuli, Diederichs, & Mavundle, 2007).

Other incentives for restoration need to be explored, whether they are economic, subsidized, or mandated. A stricter policy is needed to regulate commercial forestry production to prevent the continuous spread of IAPs, perhaps through using sterile cultivars. While the restored land can be used for grazing, farmers must follow best practices to prevent overgrazing by using rotational grazing.

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