

**Environment and Natural Resources Trust Fund  
2018 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 147-D**

Terrestrial Invasive Plant Detection Methods for Forest Lands

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**Category:** D. Aquatic and Terrestrial Invasive Species

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**Total Project Budget:** \$ 300,000

**Proposed Project Time Period for the Funding Requested:** 3 years, July 2018 to June 2021

**Summary:**

Develop and test aerial buckthorn detection methods in northern Minnesota; upgrade invasive plant risk model to prioritize forest surveys; design/test ground survey methods and integrate into annual work planning.

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**Name:** Susan Burks

**Sponsoring Organization:** MN DNR

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

Aerial photos displaying flight plan and fall color highlighting buckthorn in the forest understory; photos of the aircraft and camera used to collect aerial photography; sample risk map of the Sand Dunes state forest highlighting areas falling in the top 3 of 10 categories of risk of terrestrial invasive species invasion.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



**Environment and Natural Resources Trust Fund (ENRTF)**

**2018 Main Proposal**

**Project Title:** Terrestrial Invasive Plant Detection Methods for Forest Lands

**PROJECT TITLE:** Terrestrial Invasive Plant Detection Methods for Forest Lands

**I. PROJECT STATEMENT**

This project will build on past work to develop and test two methods of mapping terrestrial invasive plants (TIS) in forested systems. One method will adapt aerial buckthorn detection protocols used in southern Minnesota for use in northern plant communities. The second method will adapt an existing model to identify forest stands at high risk of invasion and subsequent damage, and design and implement stand-level survey methods on the most at-risk stands identified. Both mapping processes will be shared with partners and integrated into future annual work plans for state forest land. The combination will provide much needed occurrence data in areas not surveyed before. The end result would be a strong basis for prioritization and implementation of targeted treatments needed to comply with noxious weed regulations and protect long-term forest sustainability.

The purpose of the project is to identify TIS in a cost effective manner and at a stage of development most conducive to effective control, i.e. while they are still small and relatively isolated. The greatest need facing forest land managers dealing with TIS is the lack of occurrence data. Without knowing where they occur, it is impossible to plan ahead and effectively control those infestations most likely to cause long-term damage. This is especially true on state forest lands where managers are scrambling to address often conflicting priorities. Given the large acreages managed by the state, effective detection methods are a critical need to support integrated forest management.

Successful hardwood forest regeneration is extremely difficult in southern Minnesota because buckthorn is widespread and effectively outcompetes shade intolerant tree sprouts and seedlings. Buckthorn leaf drop which occurs later in the fall than most native plants, provides a window in which aerial photography can pick up buckthorn infestations. The methods developed for southern forests successfully identified buckthorn occurrence with 90% accuracy. When tested in central Minnesota (in a U.S. Forest Service funded project), the same methods produced an unacceptable level of false positives, i.e. polygons mapped as suspected buckthorn that were found to be native species when ground truthed. It appears some northern native plants hold their leaves late into the fall, confusing photo interpretation. This project will examine post data-processing methods to increase the accuracy of buckthorn detection in northern plant communities. Buckthorn occurrence data in northern Minnesota could allow managers to contain or possibly eliminate small isolated infestations before they become the well-established understory monocultures seen in southern Minnesota. This could greatly reduce the costs of attempting to regenerate and sustain infested stands.

Survey methods exist to efficiently map TIS along rights-of-way, including maintained forest roads. Cost effective survey methods for interior forests do not exist and are badly needed to detect infestations of noxious weeds like Oriental bittersweet that threaten forest sustainability. The risk model combines a number of factors such known infestations, pathways of spread, rare features at risk of damage, recent disturbances and annual stand exams to rank the risk of forest stand invasion. As harvests and planned stand exams change annually, the model produces an annual snapshot of risk. The upgraded model and stand-level survey methods will be integrated into annual work plans to identify and survey high priority areas and treat those infestations most likely to impact future desired forest stand conditions.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Adapt existing buckthorn detection methods for northern plant communities.**

Using aerial buckthorn detection methods developed in southern Minnesota and existing data collected in central Minnesota, explore geoprocessing methods (using soils, hydrology, native plant community and other geographic layers) that reduce the number of false negatives, while maximizing positive detection. Test the methods on a minimum of ten pairs of forest stands (10,000 acres or more for each of two years), reassess the methods and modify as needed with the goal of producing 75% or greater detection accuracy. Budget: \$150,000

Outcome	Completion Date
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**Environment and Natural Resources Trust Fund (ENRTF)**

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1. A minimum of 20,000 acres of northern forests have been flown, buckthorn occurrence mapped and verified to be within acceptable margins of error.	Year Three
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**Activity 2: Design and test survey protocols for forest stands at high risk of TIS invasion**

Tweak an existing risk model to match annual work planning efforts, and identify forest stands at high risk of invasion and subsequent damage. Design stand-level ground-based survey methods that can be carried out across large tracts of land. Identify and survey the stands at highest risk to test the model and survey methods. Incorporate the methods into the next set of annual work plans. Budget: \$150,000

Outcome	Completion Date
1. Using an updated risk model, all state forest lands (4.1M acres) have been evaluated producing a snapshot of risk (to be done annually in the future) and a minimum of 5000 acres of the stands at highest risk have been ground surveyed.	Year Three
2. Risk and survey protocols have been written up and incorporated into annual work planning efforts.	Year Three

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

The Resource Assessment unit (RA) of the Department of Natural Resources, Division of Forestry (FOR) would be responsible for method development and implementation. Student interns would be utilized for any necessary on-the-ground field work. RA will be the recipient of all grant funds. The FOR Invasive Species Program Coordinator will be the project manager and primary consultant to RA. The DNR Ecological and Water Resources (EWR) Terrestrial Invasive Species Program Coordinator, and key field staff will be involved to provide guidance and feedback. All, but RA staff will be providing in-kind services.

**B. Project Impact and Long-Term Strategy**

An annual run of the risk model will be completed to determine those acres to be surveyed each year. Existing funds are sufficient to survey at least 5000 acres each year once modeling and survey procedures have been established. Besides beginning to fill in missing data and to inform future treatment efforts, the procedures will allow the Division to proactively address infestations on acres with planned actions (those identified by long-term Subsection Forest Resource Management Plans or SFRMP). The enhanced buckthorn detection methods will provide a much better understanding of where buckthorn occurs and where the front(s) of invasion are. That will allow forest managers to identify hot spots that can be contained or eliminated, and those heavily areas where traditional management strategies may need reexamination in light of the persistent challenge to forest regeneration.

Obtaining aerial photography is currently expensive. But with the advent of drones, it will become a much more reasonably priced undertaking. These photo interpretation and post-processing methods should be easily adapted to photography taken with drones. Developing aerial detection methods for other TIS such as Oriental bittersweet, Japanese Barberry, winged euonymus, autumn olive and multiflora rose would be a useful endeavor once the technology has been more thoroughly tested. All of these species are considered emerging threats just now creeping into our forests. An effective method of detecting and addressing their infestations might possibly keep them from becoming the nightmare that buckthorn already is.

**C. Timeline Requirements**

The project will take three years to complete: one year to develop survey/detection procedures and two years to test and fine tune them. However, because aerial buckthorn detection requires good weather during a short phenologic window, there is a risk of being grounded for one or more flight seasons. As a result, we’re asking for a fourth year that would be used on a contingency basis only. If flights are cancelled one year, buckthorn detection work would be postponed until the next year. The odds of being shut out for two seasons in a row are slim, so a one year contingency plan should be sufficient. Project costs are not expected to change.

## 2018 Detailed Project Budget

**Project Title: Terrestrial Invasive Plant Detection Methods for Forest Lands**

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
<b>Personnel: TOTAL</b>	240,000
Project Manager: 0.3 FTE (10% FTE for each of three years)	40,000
Remote Sensing/Photo Analyst: 0.60 FTE (25% FTE for years 1 & 2, plus 10% FTE for year 3)	60,000
GIS Analyst : .70 FTE (25% FTE for years 1 & 2 plus 20% FTE for year 3)	60,000
6 Summer Interns: 2.3 FTE (1.15 FTE's for each of two years)	80,000
<b>Professional/Technical/Service Contracts: N/A</b>	
<b>Equipment/Tools/Supplies: N/A</b>	
<b>Travel: \$7,500 per year fleet (15K miles for 3 crews of 2 interns each)), \$13,100 per year lodging (\$100/night per crew per 4-day week) &amp; \$9,400 per year meals (\$36/day per intern).</b>	60,000
<b>Additional Budget Items: N/A</b>	\$ -
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 300,000</b>

### V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
<b>Other Non-State \$ To Be Applied To Project During Project Period: N/A</b>	\$ -	
<b>Other State \$ To Be Applied To Project During Project Period: N/A</b>	\$ -	
<b>In-kind Services To Be Applied To Project During Project Period: DNR Forestry grant administration (.05 FTE for each of three years), plus field support (.05 FTE for each of two years).</b>	\$ 21,250	<i>Secured</i>
<b>Past and Current ENRTF Appropriation: N/A</b>	\$ -	
<b>Other Funding History: Past federal grant (\$87K) received to test and expand SE detection methods in central Minnesota, plus state match from DNR Forestry and DNR Fish and Wildlife (\$130,500) for additional photo interpretation and to ground truth and verify aerial photography.</b>	\$ 217,500	<i>USFS</i>
<b>Other Funding History: Past state grant (\$20K from DNR Ecol &amp; Water Resources) received to develop and test buckthorn detection methods in SE Minnesota, plus in-kind funds from DNR Forestry (\$25,000) to ground truth and verify detection methods.</b>	\$ 45,000	<i>State</i>
<b>Funding History: N/A</b>	\$ -	
<b>Remaining \$ From Current ENRTF Appropriation: N/A</b>	\$ -	

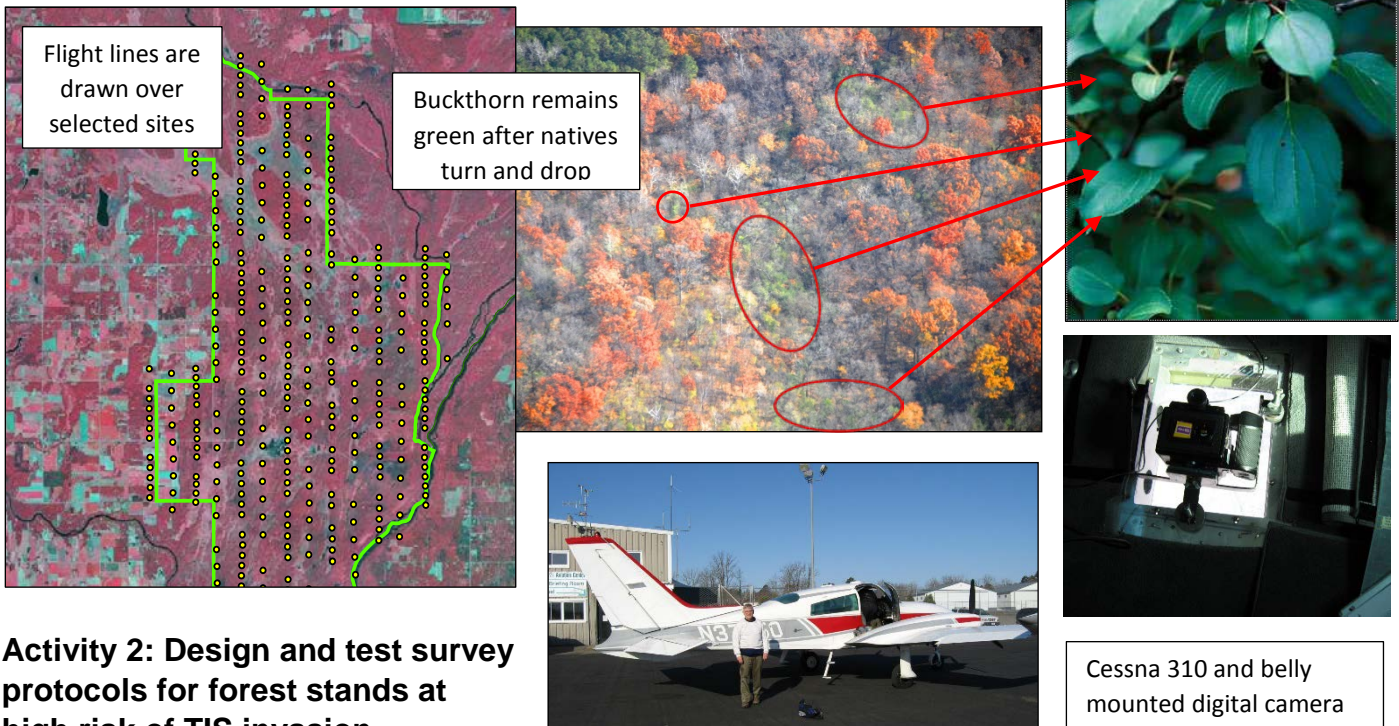
# Terrestrial Invasive Plant Detection Methods for Forest Lands

## Two Approaches to Enhance Forest Resource Protection

### Activity 1: Adapt existing buckthorn detection methods for northern plant communities

1. Utilize late fall flight window after oaks drop their leaves and buckthorn are still green
2. Develop post-processing procedures to limit false negatives (mapped polygons that are not buckthorn)
3. Digitize mapped polygons & ground truth

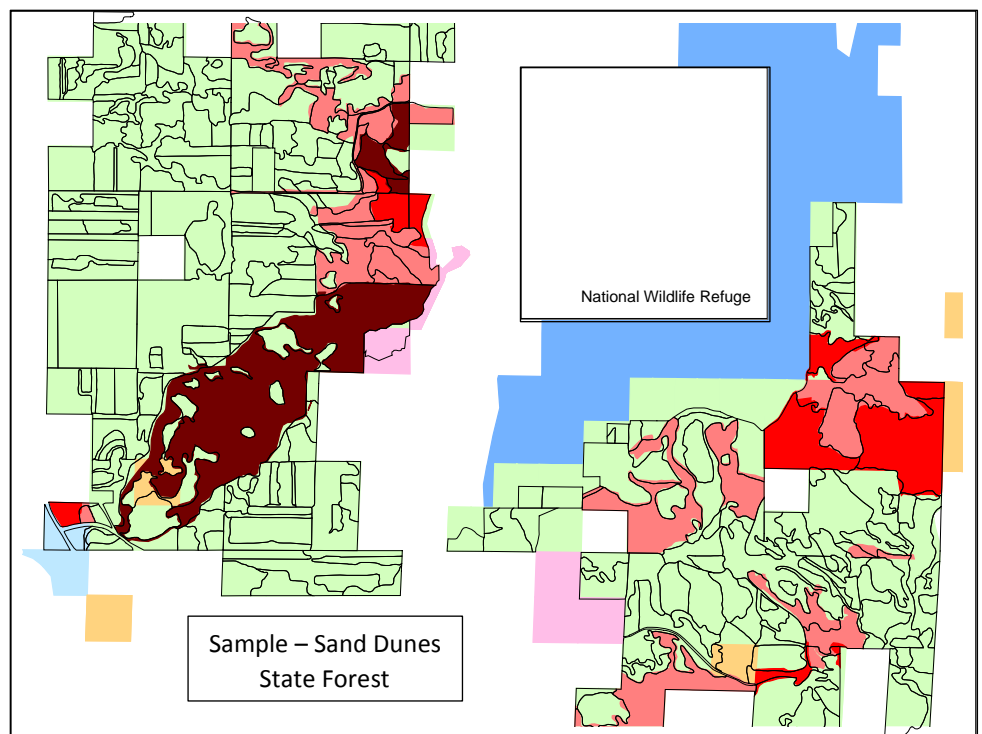
**Outcome:** Methods to detect buckthorn in northern plan communities have been developed. A minimum of 20K acres has been mapped.



### Activity 2: Design and test survey protocols for forest stands at high risk of TIS invasion

1. Test risk factors
  - Known infestations
  - Pathways of spread
  - High & outstanding CBS sites
  - Recently disturbed sites
  - Sites w/ planned activities, i.e. thinning
  - Conifer vs hardwood
  - Young stands
2. Develop annual survey procedures & field test
3. Survey 1<sup>st</sup> set of stands identified as high risk

**Outcome:** Stand-level risk assessment and survey methods have been developed and integrated into annual work plans.





## **Terrestrial Invasive Plant Detection Methods for Forest Lands**

### **Project Manager Qualification and Organization Description**

**Project Manager Qualifications** for Susan Burks, Minnesota Department of Natural Resources (DNR), Division of Forestry Invasive Species Program Coordinator

**2007 to present: DNR Forestry Invasive Species Program Coordinator.** Susan's responsibilities include implementing the division's invasive species and firewood programs. Her duties include policy development and implementation of invasive species prevention, monitoring and management activities on state forest lands, and carrying out internal and external outreach as needed to support division and department goals.

**Awards:** Commissioner's Behind the Scenes Award for developing the outreach campaign PlayCleanGo: Stop Invasive Species In Your Tracks® (2013); USFS Eastern Region Honor Award for cooperative gypsy moth management (2012).

**2000-2007: DNR central region Forest Health Specialist.** Susan was responsible for monitoring forest health in the region and serving as a consultant to staff, partners, landowners and the public on forest health related issues. She also administered the federally funded oak wilt suppression program, supporting management efforts on state and private lands.

**Awards:** Division Partnership Award (2007) for leading the department firewood taskforce that resulted in development of the new DNR firewood program; the Division Award of Excellence (2006) for proposing and then seeing two new bills through legislation on shade tree and forest pest management, and management of firewood on DNR administered lands.

**1992-2000: Missouri Forest Pathologist and forest health program leader.** In addition to the duties described above, Susan co-founded the Missouri Forestkeepers Network, a volunteer program that involved citizens in forest health monitoring of public and private lands around the state.

**Awards:** National Tree Foundation Education Award (1998) for the Missouri Forestkeepers member packet, which taught school kids and adults how to sample, assess and report forest health data using variable radius plots and their thumb in place of a forester's prism.

**Education:** BA from the Univ. of Colorado, Susan received her Masters of Science in Plant Pathology from Colorado State Univ. in Ft. Collins.

**Organization Description:** The Minnesota Department of Natural Resources works to integrate and sustain the interdependent values of a healthy environment, a sustainable economy, and livable communities. DNR's integrated resource management strategy shares stewardship responsibility with citizens and partners to manage for multiple interests. DNR protects the state's natural heritage by conserving the diversity of natural lands, waters, and fish and wildlife that provide the foundation for Minnesota's recreational and natural resource-based economy (M.S. 84, M.S. 97A). DNR manages natural lands such as forests, wetlands, and native prairies; maintains healthy populations of fish and wildlife; and protects rare plant and animal communities throughout the state. DNR manages the state's water resources, sustaining healthy waterways and ground water resources. DNR provides access to enrich public outdoor recreational opportunities, such as hunting, fishing, wildlife-watching, camping, skiing, hiking, biking, motorized recreation, and conservation education through a state outdoor recreation system that includes parks, trails, wildlife management areas, scientific and natural areas, water trails, and other facilities (M.S. 86A). DNR supports natural resource-based economies, managing state forest lands for multiple forest values (M.S. 89), ensuring the maximum long-term economic return from school trust lands (M.S. 127A), and providing other economic opportunities in a manner consistent with sound natural resource conservation and management principles. The mission of the Minnesota Department of Natural Resources is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.