

PARSONS



Remote Vegetation Clearance Solution for MPPEH Contaminated Terrain

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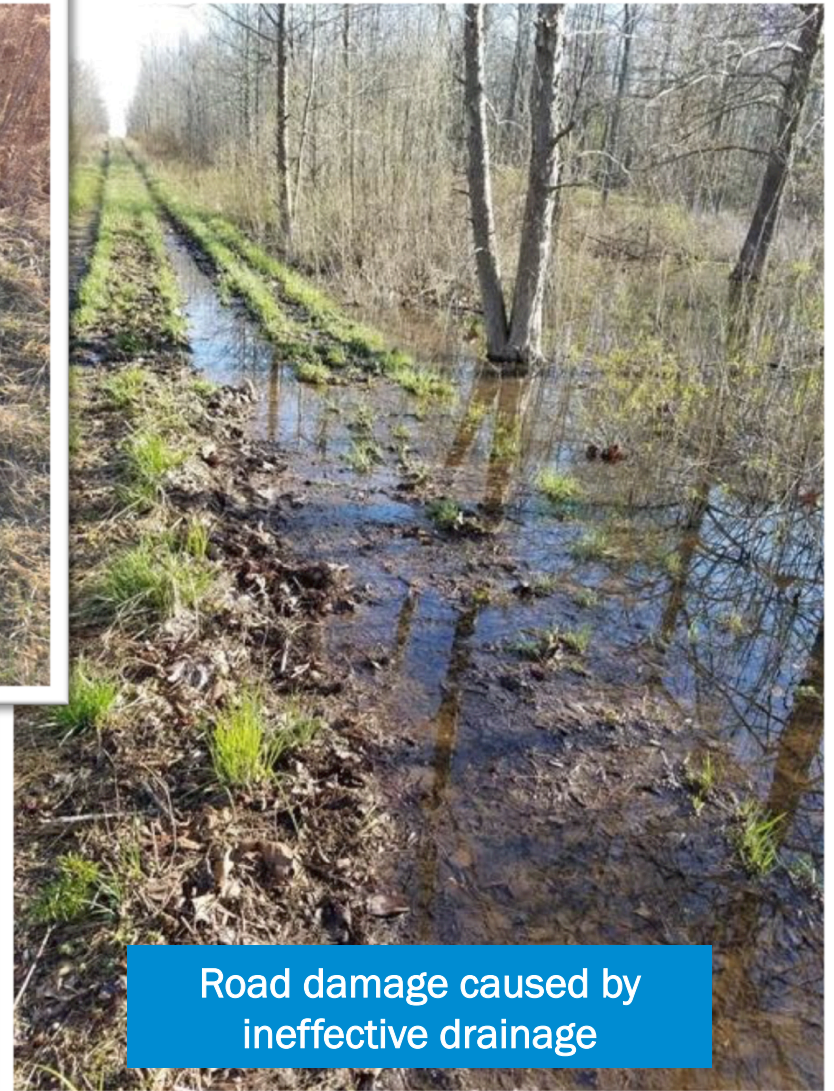




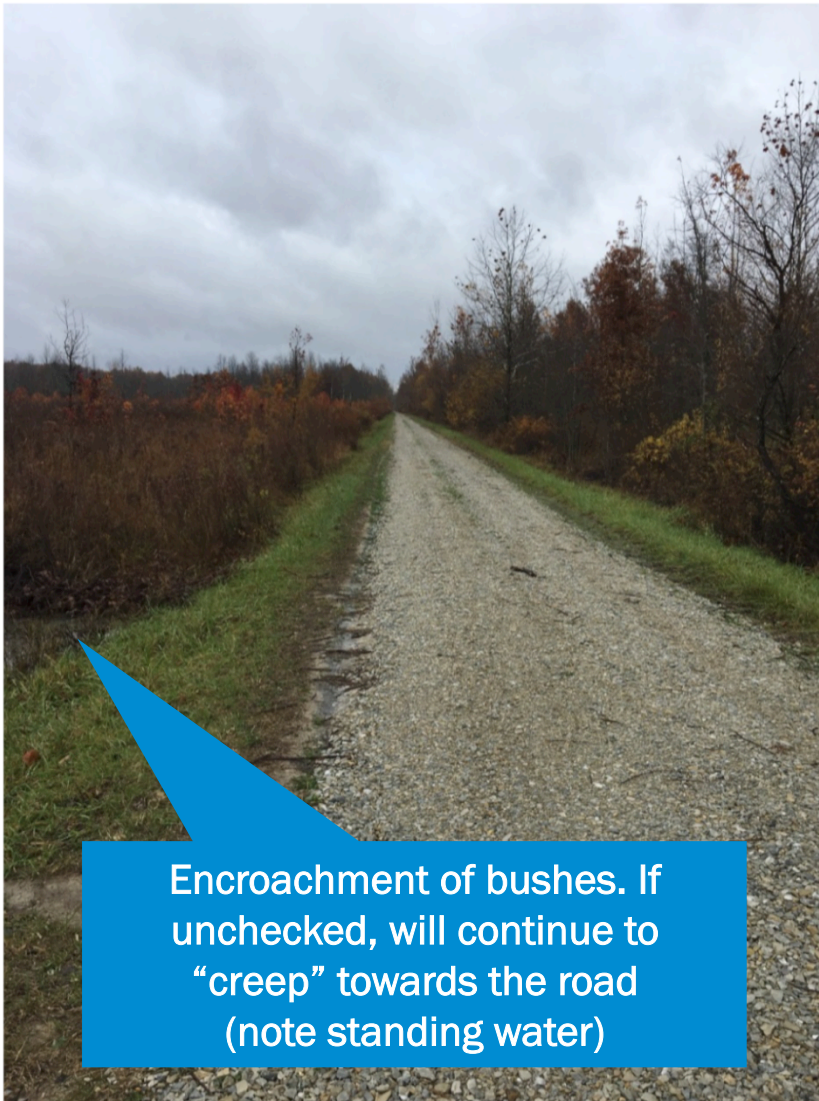
Parsons Required Task

- **PROBLEM:** Site drainage ditches were overgrown with vegetation, which caused ditches to overflow with water and become impassable; the property custodian could not safely keep ditches cutback and maintained due to presence of munitions
 - **TASK:** Parsons tasked with surface MPPEH removal and vegetation removal (to include subsurface removal of root balls for brush and small trees)
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- **CHALLENGES:**
 - Due to thick vegetation, brush, and presence of munitions, could not safely conduct standard human-operated vegetation clearance
 - Needed a way to safely clear brush so munitions could be removed and ditches were cleared of debris

Parsons Required Task



Parsons Required Task





Remote Technology Solutions

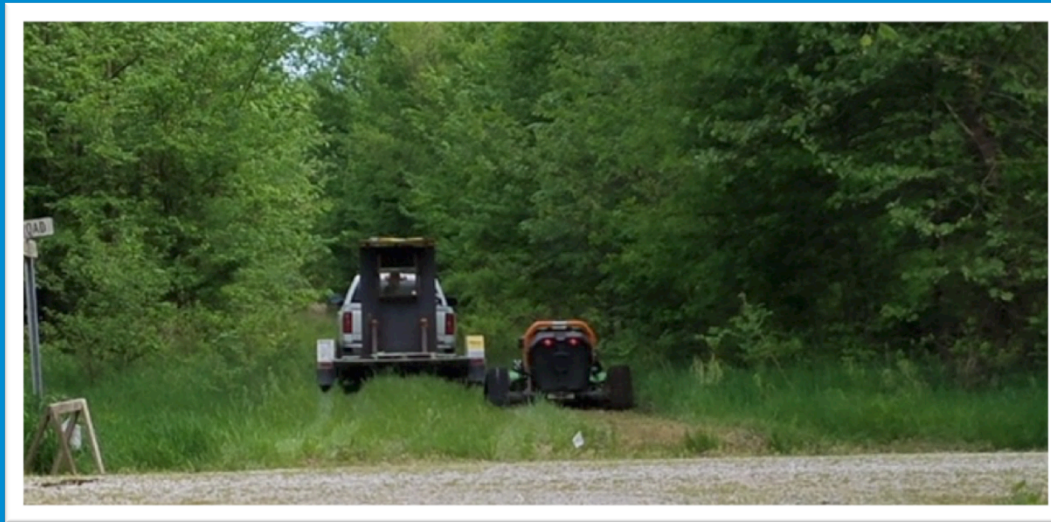
- Required Task : To remove vegetation and munitions in MPPEH contaminated drainage ditches
- Remote Technology Options
- Why we chose the Green Climber
- Field Results
- Lessons learned/ Problems encountered

How to Perform Vegetation Removal in MPPEH Contaminated Areas

Surface clearance ahead of vegetation removal is challenging in thick vegetation

- High probability of missing a potential item
- Standard vegetation clearance not an option
- Robotic Vegetation Removal was determined to be the safest option





Remote Technology Options

- Robotic Heavy Equipment Subcontractor
- Bobcat Skid Steer with Remote Configuration
- Green Climber LV600 by MDB



Image From Green Climber web site

Remote Technology Options

- **Task:** Remove vegetation and brush (up to 2" thick) from ditches with varying degrees of slope (0 - 60%) and grub 2-3 inches below ground surface to remove brush and small tree roots
- **Option 1 – Subcontract a Robotics Company to perform work**
 - Pros: Have high performance equipment with professional operators
 - Cons: Cost was significantly higher, equipment could not handle the steeper slopes
- **Option 2 – Bobcat Skid Steer with Remote Control Configuration**
 - Pros: Cost less than Option 1, Option to self perform
 - Cons: Unresponsive to inquiries, remote configurations had to be purchased and retrofitted separately, could not handle steeper slopes
- **Option 3 – Green Climber LV600 by MDB**
 - Pros: Lowest cost, responsive to inquiries, extremely versatile machine that can handle the steep slopes
 - Cons: Relatively unknown machine at time of consideration

Winner: Option 3 - Green Climber LV600

Unit Cost \$10,000 per month



- A long range remote controlled machine that can endure dangerous environments since the driver is out of harms way (>18 of 47 feet)
- Hydraulic side shifting attachments, expandable (up to 16") undercarriage tracks that together with its low center of gravity, allows Green Climber to work along 60° slopes in total safety.
- Unit can be easily hauled with pickup from location to location within the work areas.
- Available to rent or purchase
- Easy to learn and operate



Image From Green Climber web site



Green Climber LV600 Attachments

Standard Flail Head (inc. w/machine rental)

- Versatile head that works well on thick grass, light to medium brush (up to 2" thick), and steep slopes



Forestry Head (\$4,500 per month)

- Designed for dense vegetation and trees up to 3" diameter.
- Mulches debris into 1-3" pieces
- Grubs the top 1-3" of soil in the right conditions.



Field Results

- Blast Shield
- Operation
- Standard Flail
- Forestry Head



Green Climber Field Results

Blast Shield Construction



- In order to operate the Green Climber the operator needed to stay within the HFD of 450 ft – this meant the team had to be behind a blast shield
 - Built a blast shield on a trailer that could be towed behind a truck while operating.
 - The blast shield was constructed based on DDESB specifications for an unintentional blast.
- Material used included:
 - 1.5 inch A36 Steel Plate (6' x 4')
 - Two 3" thick plexiglass (18" x 24")
 - 16' trailer
 - Square and angle iron to build the frame
 - Welding equipment and operator

Minimum Thickness to Prevent Perforation		
	<u>Intentional</u>	<u>Unintentional</u>
4000 psi Concrete (Prevent Spall):	14.62	7.33
Mild Steel:	2.82	1.43
Hard Steel:	2.31	1.17
Aluminum:	5.39	2.85
LEXAN:	11.10	7.30
Plex-glass:	9.91	5.69
Bullet Resist Glass:	9.14	4.99

Green Climber Field Results

Blast Shield Construction



Green Climber Field Results

Blast Shield Construction



Blast shield on trailer



Looking through 6" plexi-glass

Green Climber Field Results

Operation



Controls

- Tutorial and training provided when machine was delivered.
- The controls are user friendly and well labeled.
- Our operators were comfortable with the machine after the first day.



Image From Green Climber web site



Image From Green Climber web site

Maintenance

- Teeth are easy to replace when worn out.
- Ran entire day on full tank of diesel.
- Customer service was excellent

Green Climber Field Results

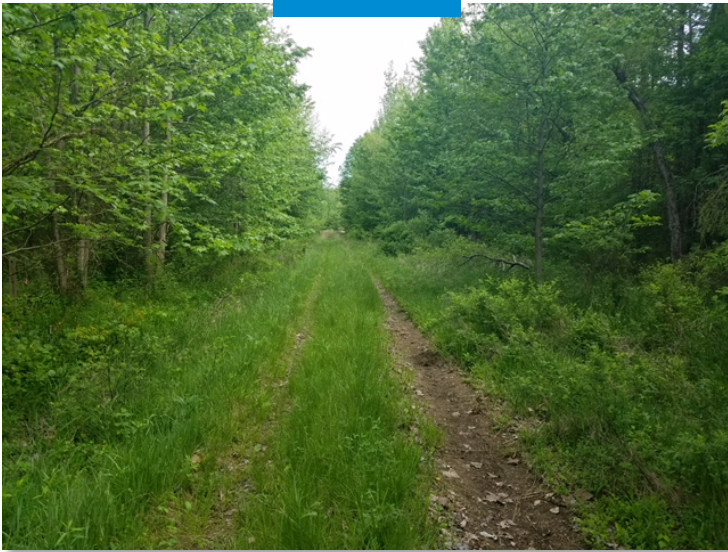
Standard Flail



Before

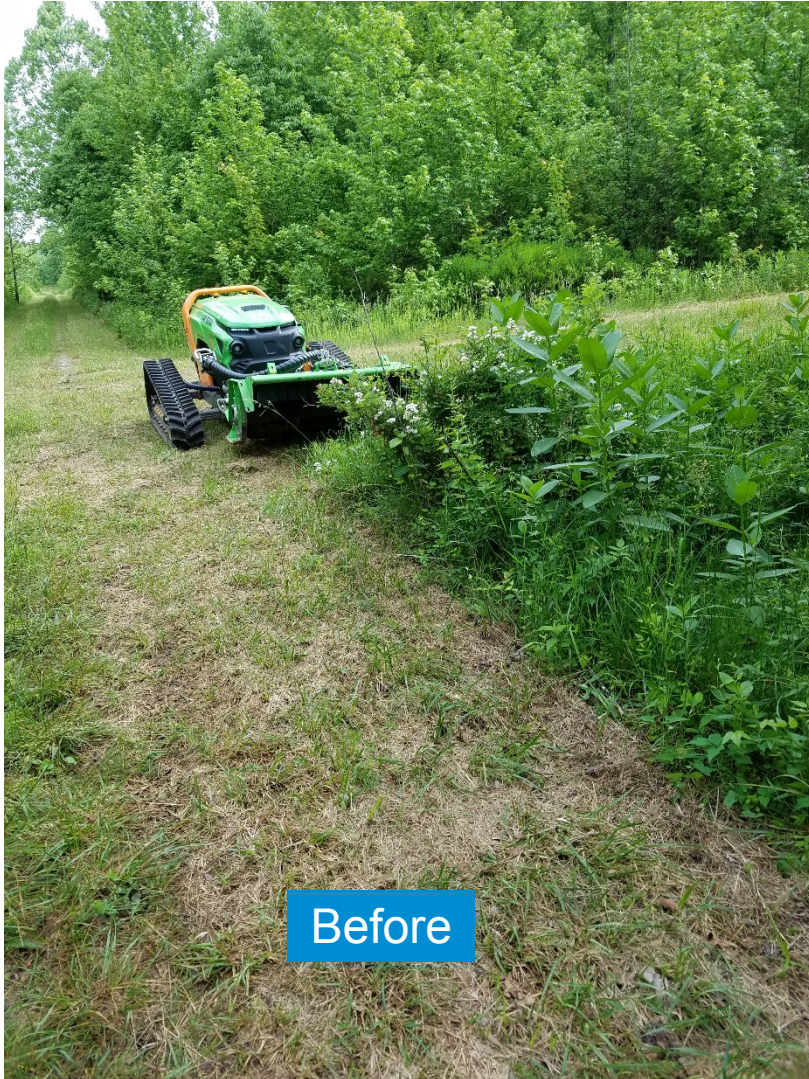


After



Green Climber Field Results

Standard Flail



Green Climber Field Results

Forestry Head



Before



After



Lessons Learned

- Operation Distance
- Operation in Muddy Conditions
- Forestry Head Grubbing in Muddy Conditions
- Exposed Fuel Filter

Lessons Learned

Operation Distance



- **Problem:**

- The range of the remote control operational range was significantly reduced when operating it from behind the 1.5" steel blast shield.

- **Solution:**

- Add an external antennae to the top of the blast shield.



Lessons Learned

Operation in Muddy Conditions

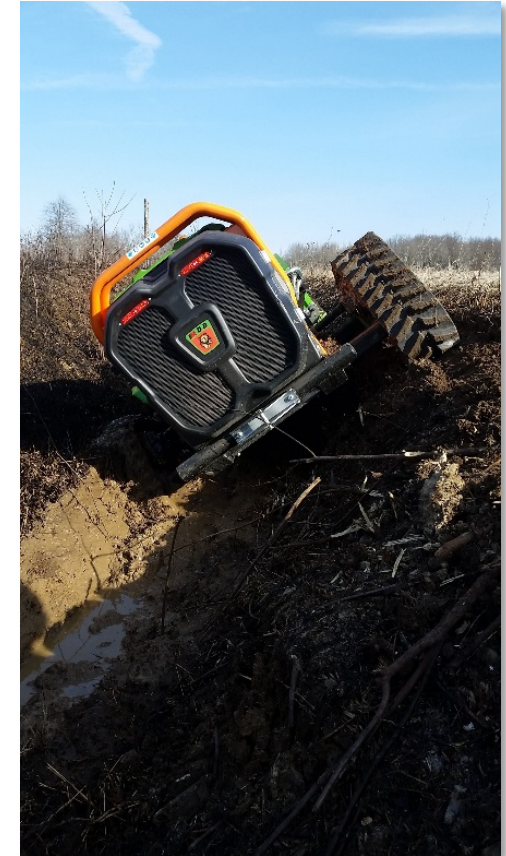


- **Problem:**

- With the Green Climber have such a wide base and tracks, we thought it would have little difficulty with muddy conditions but on steeper slopes the unit would slide laterally and get stuck in the bottom of the ditch

- **Solution:**

- As the operators gained experience, they learned what the Green Climber could and could not handle; also extending tracks out an additional 16-inches extra helped.
- Green Climber does have a handy tow hook on the back to help get it out when it is stuck



Lessons Learned

Forestry Head Grubbing in the Mud



- Problem:

- The forestry head did not excel in muddy conditions; it would beat down the mud and smear up the terrain more than grubbing it and removing roots

- Solution:

- As operators gained experience, they learned when ground was too wet to use the forestry head



Lessons Learned

Exposed Fuel Filter

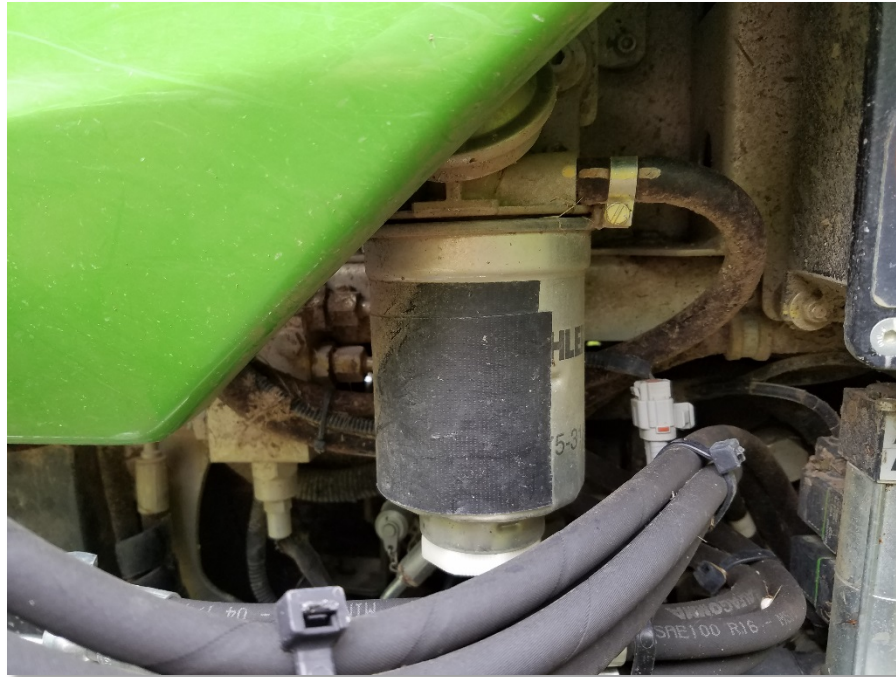


- Problem:

- The location of the fuel filter left it exposed to branches and sticks; one filter was punctured and caused a production delay

- Solution:

- Our team created a shield to protect fuel filter; Green Climber working on an engineering solution



Conclusion

- We have safely cleared 40 miles of roadside ditches
- The robotic vegetation removal results in ~1 mile of removal per day
- Cost-effective approach





Questions?
