F16 – Integrating LiDAR and Mobile Technology in the Community Wildfire Planning Process
MN Firewise Program
Organization

- Statewide Coordinator
- 3 Regional Specialists
- 1 Program Specialist
CWPP Process

• Development at the county level
  – Encourages more resource sharing
  – Encourages coordinated planning
  – Encourages more communication among FD’s in the county
  – A wider population base is served
CWPP Process

• More decision makers: More time needed to reach agreement
• Bring more wants/needs to the table
LiDAR Level 1
Home Risk Evaluations
How did we get here?

Minnesota Elevation Mapping Project

• How did we get here?
  – 2000 – 2005
    • Small, non coordinated projects
      – 35 – 1500 square miles
      – County based (typically)
      – Proprietary Data
    • Not a lot of knowledge
    • Bare earth and contours
How did we get here?
Minnesota Elevation Mapping Project

- 2006
  - State received $500k for Red River Project
  - Cooperative project involving
    - MnDNR
    - MnDOT
    - White Earth Tribal Council
    - Wild Rice Watershed District
    - Corp of Engineers
How did we get here?

Minnesota Elevation Mapping Project

• How did we get here?
  – Digital Elevation Committee
    • Governor’s Council on Geographic Information subcommittee
    • Goal – to build a statewide, publicly available high accuracy DEM
    • Provide Technical Guidance to Organizations collecting LiDAR data
How did we get here?
Minnesota Elevation Mapping Project

• Hard Realizations
  – Money was tough to come by
  – Would likely be a piece-meal effort
    • Develop Standards to ensure data compatibility across collects
    • Provided guidance and technical expertise
  – Required “champion” to push at the legislative level
    • State employees have limited ability to push legislative efforts
How did we get here?
Minnesota Elevation Mapping Project

• Disasters in NW and SE MN
  – Special Session provided $$ for relief and mitigation
  – ....And LiDAR...

• Clean Water Legacy Fund dedicated fund available for clean water projects
  – Convinced legislators of the value of elevation data
  – Project Scope and Costs
    • 40,000 square miles to complete state
    • $8.5 million
  – Supported Funding
    • $2.8 Million FY10
    • $2.8 Million FY11
Minnesota Elevation Mapping Project

- **Project Specifications**
  - Closely aligned with UGSS LiDAR Base Specs V13
    - 1.5 meter postings
    - Classified LAS Data
- **Vendor Deliverables**
  - Point data – LiDAR LAS files
  - Edge of water break lines
  - 1 meter DEM units in meters – break line enforced
- **Stored at the USGS**
LiDAR Level 1
For Firewise?

• Efficient way to establish localized baseline assessment.
  – Reduce CWPP Planning time by 70% (18 to 6 mos.)
  – Labor cost reduction by 80-90% (processing time)
• 2 weeks of aerial photo interpretation by interns became 35 hours of computer processing time.
• Standardized process minimizes human errors.
• LiDAR (multipath) can “see” through vegetation.
LiDAR Level 1
ArcGIS Toolbox

Available for download here:

https://my.syncplicity.com/share/khwquq6v4ma2vu2/Fire-riskToolbox

Integrating LiDAR and Mobile Technology in the Community Wildfire Planning Process

2015 Backyards and Beyond
LiDAR Level 1
ArcGIS Toolbox

• Install tool into ESRI ArcMAP.
• Download LAS files to single directory.
• Test the tool on a single file.
• Use tool inputs to create an Excel spreadsheet for copying into Level 1 Assessment from LiDAR LAS batch processor
  – Right-click tool in toolbox and select batch.
  – Copy/Paste all the cells for each LAS to be processed
LiDAR Level 1
ArcGIS Toolbox

• Files created include:
  – Shapefiles of rated structure footprint and centroid
  – Raster of the vegetation proximity for validation

• Precision vs Accuracy
  – Reclass and create density surface model (DSM) to increase “Accuracy”.
LiDAR Level 1
Inputs

- Use Excel to concatenate the file names, etc for each LAS to be processed.
- Paste into the Batch Processor.
LiDAR Level 1 Outputs

Generated from Tool  Manual Reclass

Integrating LiDAR and Mobile Technology in the Community Wildfire Planning Process

2015 Backyards and Beyond
LiDAR Level 1
Outputs – DSM to Improve “Accuracy”

- Reclass
  - 1 = 0  >100’
  - 2 = 5  >30’
  - 3 = 10  0-30’
  - 4/5 = 40

Generated from Tool  Manual Reclass
LiDAR Level 1
ArcGIS Toolbox

Available for download here:

https://my.syncplicity.com/share/khwquq6v4ma2vu2/Fire-riskToolbox
Minnesota Firewise Mobile Application

• **Platform:**
  – Linux OS
  – Apache Server
  – Web Application
    • Ruby on Rails
    • Postgres Database with PostGIS Geospatial Extension

• Currently in a rewrite, so once complete, source code will be made available.

• **Requirements:**
  – **Mobile**
    • Mobile device with data plan
      – Caching currently unavailable
    • Mobile browser (Safari, Chrome, Firefox)
  – **Desktop**
    • Web browser (Chrome, IE, Firefox)
  – Pen and paper
    • Data can be entered after the fact or in areas with poor cell coverage.

2015 Backyards and Beyond
Mobile Application

- Create new evaluations
- View existing evaluations
- Select existing structure to evaluate from Level 1 database.
- Edit the evaluation template (versions are maintained)
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Text</th>
<th>Applies to questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Post home address so it is visible from the road in both directions</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Cut trees and brush along driveway to allow access. Create a minimum clearance of 12 ft wide by 14 ft high</td>
<td>10, 11</td>
</tr>
<tr>
<td>3</td>
<td>Clear an area by the house so that emergency vehicles can turn around and setup</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Replace conifer trees near the house by planting hardwood trees</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Remove ladder fuels - prune up conifer trees at least 6 feet above ground vegetation. Clip tall grass</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>Start thinning pines near house. Within 5 years, trees should be spaced 20 to 30 feet apart. Cut</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Chop weeds and tall grass within the first 30 feet of the house and primary buildings. Keep this area</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>Relocate firewood pile and other flammable accumulations at least 25 feet from structures</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>Haul slash to community brush collection site or rent a chipper and make mulch. Limit outdoor burning to</td>
<td>21</td>
</tr>
<tr>
<td>10</td>
<td>Replace / repair roof with Class A materials</td>
<td>22</td>
</tr>
<tr>
<td>11</td>
<td>Box in soffits / screen attic vents</td>
<td>24</td>
</tr>
<tr>
<td>12</td>
<td>Enclose the underside of deck/addition with skirting</td>
<td>28</td>
</tr>
<tr>
<td>13</td>
<td>Keep your roof clear of leaf and needle buildup</td>
<td></td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS/COMMENTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subdivision Design Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Single access road</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Road with less than 20 ft</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3. Cut-de-sac less than 100 ft diameter</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4. Dead end road more than 200 ft long</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5. Street signs not reflectorized or missing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Site Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Water source more than 20 min round trip</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7. Address not visible from road</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8. Driveway gated or locked</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>9. Steep driveway or inadequate surface</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10. Driveway less than 12 ft wide</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>11. Driveway less than 14 ft high</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>12. Driveway over 1508 ft long / no turn-around</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>13. Trees mostly evergreen in defensible space</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>14. [or] Trees mixed evergreen / hardwood</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>15. Ladder fuels present</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>16. Evergreen tree crowns touching</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>17. Tall grass or brush within defensible space</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>18. Property steep sloped (6-20%)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>19. Firewood (exc) stored within 30 ft of structure</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>20. Outbuildings within 30 ft of home</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>21. Powerlines close to trees</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>22. Outdoor deck, burning on property</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Structural Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Wood shingles or degraded asphalt roof</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>24. Flat roof</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>25. Open soffits or attic vents</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>26. Large windows (larger than 6’ x 5’)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>27. Open foundation</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>28. Vinyl or wood siding</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>29. Wood deck, unskirted, &lt; 3 ft above ground</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

0 - 20: LOW-(0-20) The chances of your home surviving a wildfire are GOOD. Keep maintaining your property!
21 - 48: MODERATE-(21-48) The chances of your home surviving a wildfire are FAIR. Minor improvements will make it even more fire-resistant.
49 - 85: HIGH-(49-85) Chances of your home surviving a wildfire are NOT GOOD. Many improvements are necessary to improve your home's survivability.
86 - 134: EXTREME-(86-134) Your home MAY NOT SURVIVE if a wildfire passes through your property. Take a serious look at the recommendation above.

**Notes:**
- Site factors 13-28 should be evaluated within the 50 foot defensible space. The defensible space should extend around and include any outbuilding or garage that extends INTO the main structures 30 foot defensible space.
**Subdivision Design Factors**

1. Single access road
2. Road with less than 20 ft
3. Cul-de-sac less than 100 ft diameter
4. Dead end road more than 200 ft long
5. Street signs not reflected or missing
6. Water source more than 20 min round trip
7. Address visible from road
8. Driveway gated or locked
9. Deep driveway or inadequate surface
10. Driveway less than 12 ft wide
11. Driveway less than 14 ft high
12. Driveway over 15 ft long / no turn-around
13. Trees mostly evergreen in defensible space
14. [or] Trees mixed evergreen / hardwood
15. Evergreen tree crowns touching
16. Tall grass or brush within defensible space
17. Property steep sloped (≥20%) +
18. Firewood (dry) stored within 30 ft of structure
19. Cut-buildings within 30 ft of home
20. Powerlines close to trees
21. Outdoor debris burning on property

**Structural Factors**

22. Wood shingles or degraded asphalt roof
23. Flat roof
24. Open soffits or attic vents
25. Large windows (larger than 5 x 5)
26. Open foundation
27. Vinyl or wood siding
28. Wood deck, unskirted, < 3 ft above ground

**RECOMMENDATIONS/COMMENTS**

- Post home address so it is visible from the road in both directions. [7]
- Cut trees and brush along driveway to allow access. Create a minimum clearance of 12 ft wide by 14 ft high. [10, 11]
- Clear an area by the house so that emergency vehicles can turn around and setup. [12]
- Replace conifer trees near the house by planting hardwood trees. [13]
- Remove ladder fuels - prune up conifer trees at least 6 feet above ground vegetation. Clip tall grass near pines along edges. [14]
- Start thinning pines near house. Within 5 years, trees should be spaced 20 to 30 feet apart. Cut wood may be marketable if sold in quantities with neighbors. [15]
- Chop weeds and tall grass within the first 30 feet of the house and primary buildings. Keep this area mowed, clean and green. [16]
- Relocate firewood pile and other flammable accumulations at least 25 feet from structures. [18]
- Haul slash to community brush collection site or rent a chopper and make mulch. Limit outdoor burning to winter season. [21]
- Replace / repair roof with Class A materials. [22]
- Box in soffits / screen attic vents. [24]
- Enclose the underside of deck/addition with skirting. [26]
- Keep your roof clear of leaf and needle buildup.

**HOME HAZARD RATING:**

**EXTREME:** (85-134) Your home MAY NOT SURVIVE if a wildfire passes through your property. Take a serious look at the recommendation above.

**Notes:**

Site factors 15-28 should be evaluated within the 30 ft defensible space. The defensible space should extend around AND include any outbuilding or garage that extends INTO the main structure's 30 ft defensible space.
Minnesota Firewise Desktop Application

- **Platform:**
  - Linux OS
  - Apache Server
  - Web Application
    - Ruby on Rails
    - Postgres Database with PostGIS Geospatial Extension

- **Requirements:**
  - Desktop
    - Web browser (Chrome, IE, Firefox)
  - Application is the repository for evaluation data for MNDNR Firewise.
Conducting Level 1 Assessment

Rating Method of Determination The following list contains the risk values and method of applying the value to a structure that is identified on an aerial photograph

1- No Risk In a development with no or few trees around it.

2 - Low Risk In a development with trees, but home is at least 30 feet from tree canopy edge. (30 feet is about the width of a house)

3 - Moderate Risk Home is within 30 feet of the tree canopy edge. When trees are inside the defensible space of a home, wild fires have a greater chance of starting the house on fire.
Conducting Level 1 Assessment

Rating Method

1 - No Risk In a development with no or few trees around it.
2 - Low Risk In a development with trees, but home is at least 30 feet from tree canopy edge. (30 feet is about the width of a house)
3 - Moderate Risk Home is within 30 feet of the tree canopy edge. When trees are inside the defensible space of a home, wild fires have a greater chance of starting the house on fire.

4 - High Risk The outline of the home is obscured on at least one side by the tree canopy.

5 - Extreme Risk The outline of the home is obscured on the south or west side or on more than one side by the tree canopy.
Step 1: Log in to Firewise in the Classroom Internet Map Server

webapps1.dnr.state.mn.us/firewise-classroom

If you already have an account, please login.

Enter your email and password below; then click on the Login button to continue.

Email: [input field]
Password: [input field]

Forgot your password?

Firewise Authorization Form
Step 2 Navigate to Project Area

1. Type: city name
2. Click GO!
3. Place List page appears
4. Click on city name

Air photo of city appears
Step 3: Add Foreground Layers

1. Click on + in front of Residential Structures, Check L1 layer

2. Click on + in front of Foreground Layers to open the layers

3. Check the boxes in front of:
   - Roads
   - Lakes and Rivers
   - Public Land Survey

Overlays help students find their assigned section.
Step 4: Zoom Out to See All Sections in City

1. Click on the scale bar to Zoom out to see all sections in the city.

2. Click on the + boxes to close Residential Structures and Foreground Layers.

3. Click on the line and move it up to show more blank area below the line.
Step 5: Zoom In on Assigned Sections

1. Pan over to locate your assigned section

2. Find your assigned section. Double click on the section number to zoom in. Keep zooming in until you can see homes.

3. Another option is to click on bar in the scale bar to zoom in on homes in your Section
Step 6: Adding and Locating a Feature

1. Click the – to open Feature Detail

2. Click on Add Feature then Move/Set Feature Location

3. A dialog box appears, click OK to close the box

4. Click on a house to be rated

Example
Step 7: Adding Feature Data

1. A Red symbol will appear on the house to be rated

L1-Residential

Name of Fire District

Name of City

FSA

1 - 5

School project name

Click create to save feature
Step 8: Create Density Surface Model

1. Click on Density Surface Generation Option

2. Elevate 1-5 values to reflect Wildfire Risk Levels

3. Click on Make Surface
Step 9: Document DSM Results

1. Copy Results and paste image into Presentation software
2. Locate High Risk Areas
3. Copy images of high risk areas into presentation
Minnesota Firewise Desktop Application

- Application can also perform DSM on uploaded Level 2 home risk evaluation data.
- Downloaded data can be re-analysed for structure, site, or access issues.
- Mobile data will be automatically uploaded into the system.
  - May remove current L2 processing and just use mobile processor for inputting data.
Discussion?