Rebuilding an Eroding Bank on an Inland Lake

A comparison of Traditional and Prefabricated Encapsulated Soil Lifts

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Today's talk

- Background on shoreline erosion control in MI
- KBS Shoreline Demonstration Area
- Goals of the soil lift project
- Site characteristics , project design and permitting constraints
- Construction process
- Plant material
- Study design
- Results 2011 – 2013
- Conclusions
- Lessons learned

Background

- Michigan Natural Shoreline Partnership
  - Public/private partnership formed in 2008
  - Alternatives to vertical sea walls
  - Education, product/technique development, influence policy and regulation

Background -- continued

- Certified Natural Shoreline Professional
  - Certification training for waterfront contractors
    - Landscape and marine contractors
    - Landscape architects
    - Restoration ecologists
    - Consulting engineers
    - Natural resource professionals
  - Offered nine times since 2010
    - Three days classroom, one day field, 100 question exam
    - Nearly 200 certified contractors
    - Web-based listing – recommended by MDEQ permit staff

MICHIGAN NATURAL SHORELINE PARTNERSHIP

Background -- continued

- Certified Natural Shoreline Professional
  - Continuing Education Units (CEUs)
    - Required to maintain certification
    - Six credits every three years
    - MNSP awards credits


Stone Toe/Soil Encapsulated Lifts
Soils
Erosion Fabric
07/14/2011


CAT
07/14/2011


08/07/2013

MSU Kellogg Biological Station (KBS)

- Located on east side of Gull Lake in southwest lower Michigan
  - ¼-mile of shoreline
  - 2,000-acre lake
  - Moderate to high wave energy
  - Ice action
  - Boating
  - Vegetation removal
  - Mowed to water's edge
  - Active and ongoing erosion

KBS Shoreline Management Demonstration Area

www.shoreline.msu.edu

- Constructed 2000 - 2001
  - 400 linear feet on Gull Lake
  - Multiple landscape designs and erosion control structures
    - Rock rip rap
    - Live fascine
    - Encapsulated soil lifts (vegetated geogrid)
    - Live crib wall

80 feet of live fascine

- Installed in 2001
  - Slow but continual failure
  - Minor repairs had failed
  - Active and ongoing bank erosion by spring 2011


04/12/2011

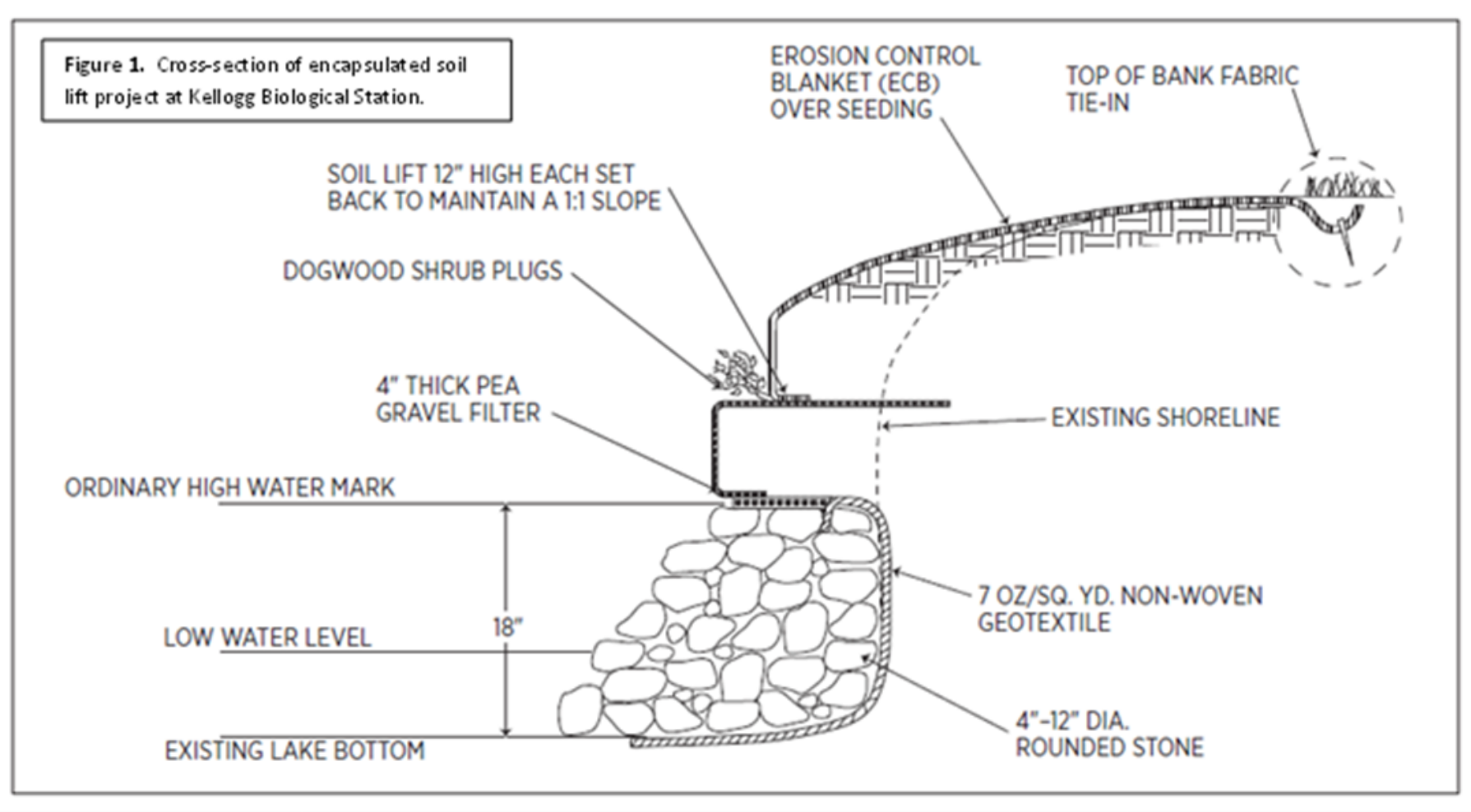

04/12/2011

July 2011: replaced fascines with 80-feet of encapsulated soil lift on a rock base

- 40-feet each:
  - Traditional built-on-site soil lifts (more time)
  - Prefabricated "coir block lift system" (more $)
  - Side-by-side
  - Identical plant species, plant materials, planting techniques
- Compared:
  - Plant establishment
  - Invasion by native and nonnative weed species
  - Shrub plug survival
  - Ability to withstand wind, wave and ice action
- Prediction: The two lift types would perform similarly.


07/12/2011

Project design



Project design

- Cross-section drawing on page 3
- Rock base (18” high)
  - Ordinary High Water Mark (OHWM)
  - Waves
  - Ice
- Two courses of each type of lift
- Permit constraints:
  - Rock base no more than two feet out from re-contoured shoreline
    - Minimize encroachment on lake bed
    - Steeper slope than desired
- Other designs to consider
  - Rock base v. no rock base
  - Various heights (up to 8 ft.) and slopes
    - Bank re-contouring may accommodate gentler slope

Building the rock base

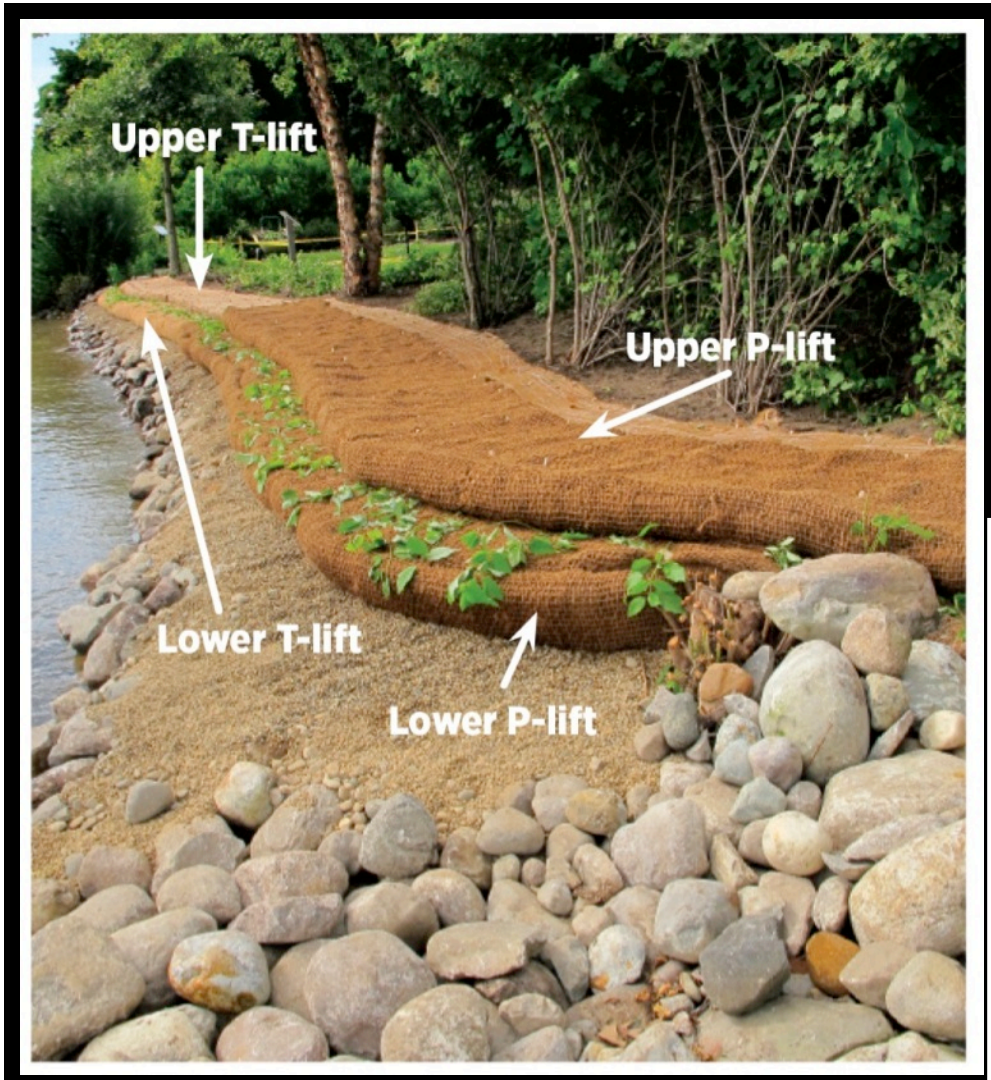
Construction video at: www.mishorelinepartnership.org

Two lift types
Identical planting plans

- Plant material
  - Seed
    - Cover crop – annual rye and oats
    - Native grasses and wildflowers
  - Shrub plugs between the lifts
    - Native dogwoods
- Species
  - Seed - mostly wetland and some upland
- No concrete plans for irrigation
  - Dependent upon capillary action of lake water
  - Drought of 2012…
    - No rain
    - Low water levels
    - Lack of irrigation on P-lifts

Study design by Dr. Jen Lau, KBS

- Total of four lifts studied
  - Traditional (T) – upper and lower
  - Prefabricated (P) – upper and lower
- Twenty 1/2-meter quadrats
  - Five located along established transects in each of the four lifts
- Monitored for three growing seasons (2011-13)


Upper T-lift
Upper P-lift
Lower T-lift
Lower P-lift


Three weeks
08/08/2011

Study design -- continued

- Seedings were monitored:
  - Percent vegetative cover estimates
    - Ground level
  - Number of native and non-native weed species
    - Included in percent cover estimates
- Shrub plugs monitored
  - Direct stem count
- Lift performance against waves and ice
  - Three-point scale
    - 1= total failure
    - 2 = partial failure
    - 3 = no failure

Results 2011-13: Vegetative cover

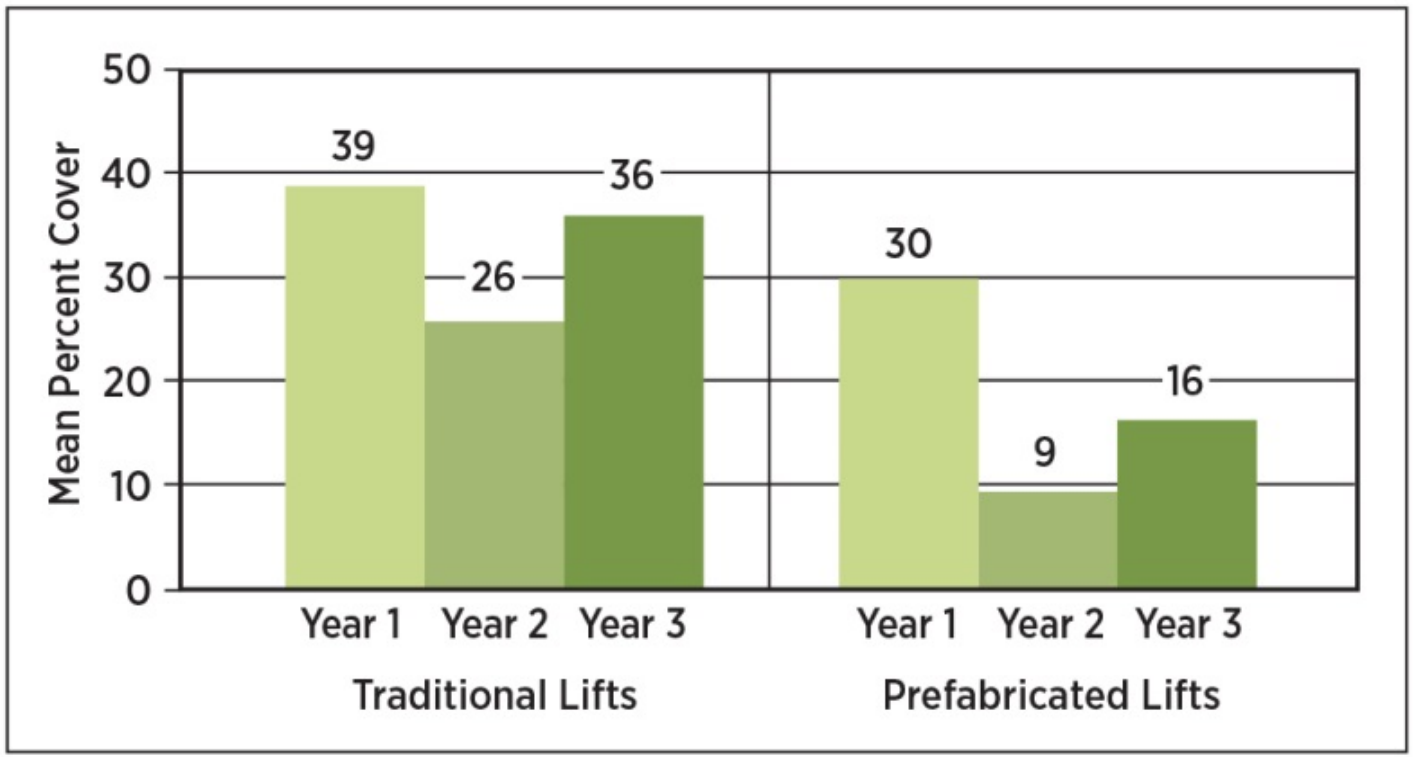


Figure 4. A comparison of the mean percent vegetative cover over the 3-year study period on the traditional (T-lift) and prefabricated (P-lift) lift structures.

Results 2011-13: weed species

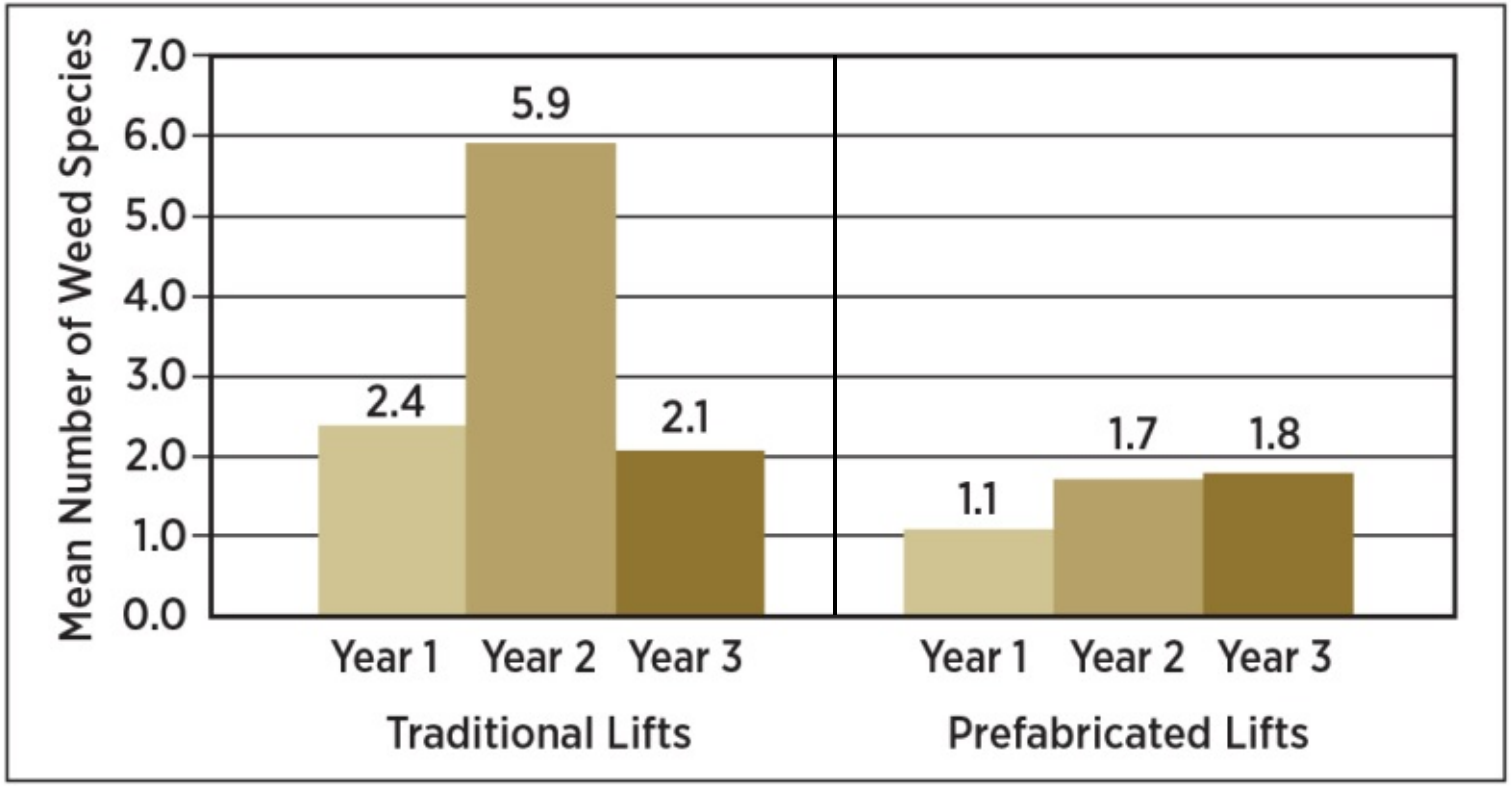


Figure 5. A comparison of the number of native and nonnative weed species present on traditional and prefabricated lifts over the 3-year study period.

Results 2011-13: shrub plugs

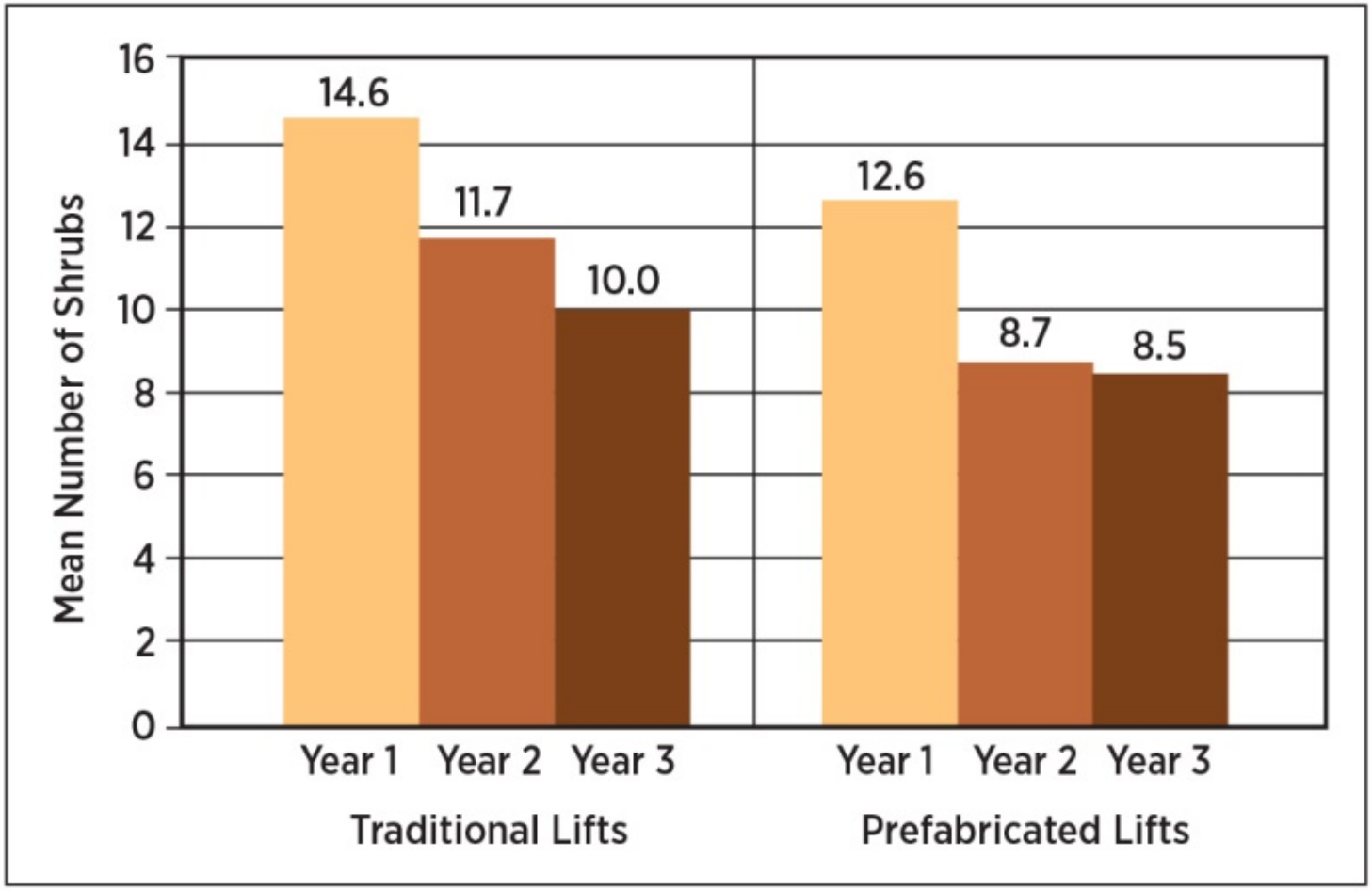


Figure 6. A comparison of *Cornus* spp. shrub survival over the 3-year study period.

Lift performance against waves and ice

- Three-point scale
  - 1= total failure
  - 2 = partial failure
  - 3 = no failure

Traditional lift (upper) -- first winter

Prefabricated lifts -- first winter

Conclusions

- In terms of:
  - Plant establishment
  - Resistance to invasion by weeds
  - Ability to withstand waves and ice

- No significant differences (at this site over the three-year study period) between:
  - Traditionally-built soil lifts
  - Prefabricated coir block lift system

Lessons learned

- Closely match seed mix to anticipated soil moisture levels as related to the OHWM
  - Plan for irrigation if above OHWM
- Minimize foot traffic
  - deer and human
- Protect lifts by double-wrapping
  - Erosion control blanket
  - Light-grade woven coir mat
- Plug-plant lifts with long-rooted native species
  - More $
  - Quick establishment
  - Under-seed
- Or…

Live dormant cuttings?

-Greater soil contact
-Greater moisture retention
-Adventitious rooting
-Seasonal limitations

April 2001

June 2005


Another thought: Place lower lift below OHWM?
-Greater capillary action of water into lifts
-No waves or boat wake
-Potential loss of soil through blanket

KBS soil lifts
August 2013