



Flood-dependent forests in a flood-intolerant world

Can we coexist with cottonwood?

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Background

Cottonwood reproduction & ecology

Research

Demographics, flood control & land use

Restoration



Seed

Root access to water table
Slow flood recession rate
No competing vegetation
Full sun



Pioneer species



Root suckers



Rooted branch



Flood training



Coppicing



Once
established,
impressive
growth and
ability to persist

Riparian species



Ecosystem engineer



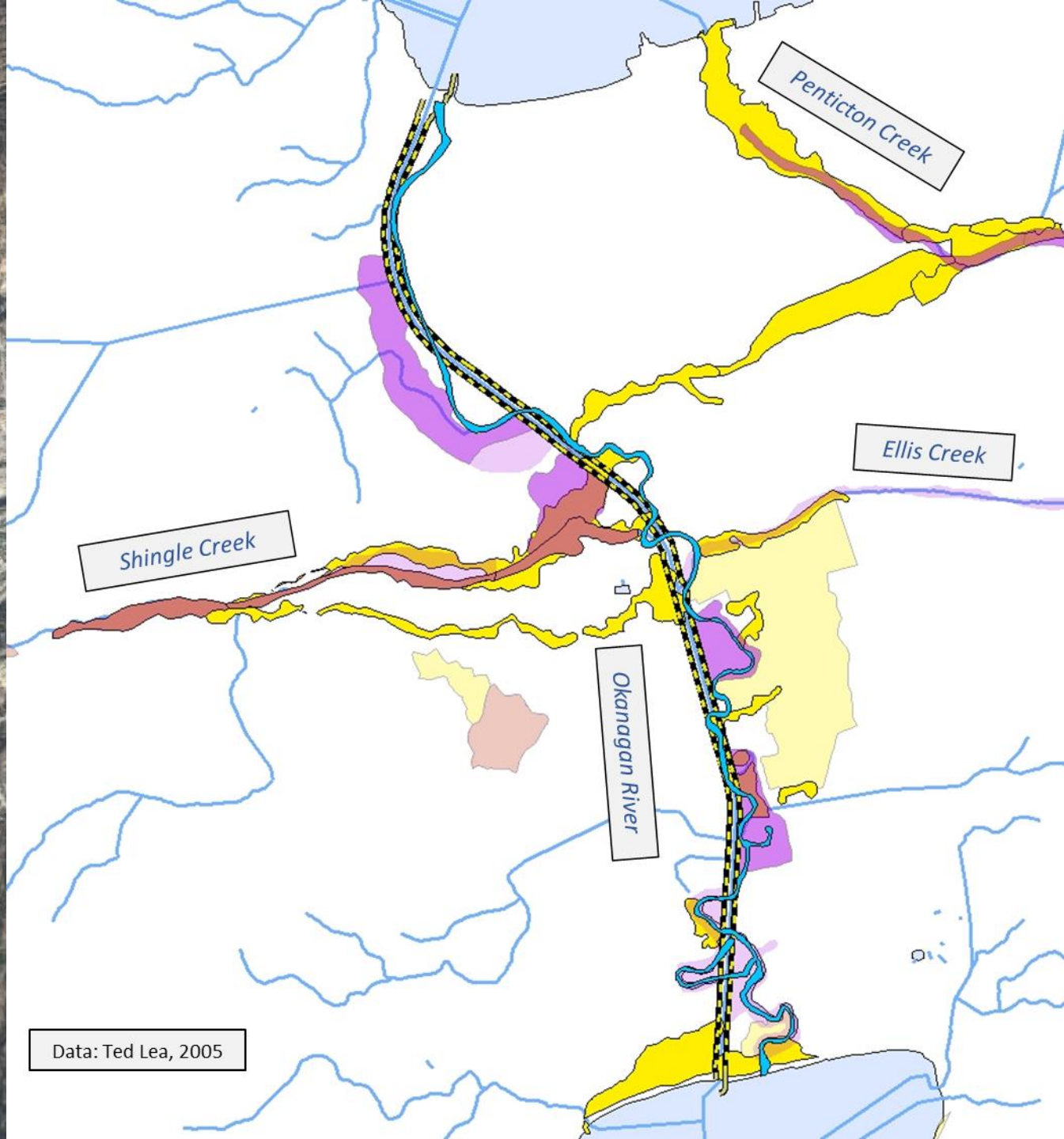
Foundation species



Aquatic & terrestrial ecosystems



63% cottonwood
forest cover lost in the
Okanagan-
Similkameen since
European colonization
(Lea, 2008)



River training

Reduces cottonwood nursery space

Interferes with feedbacks between river and trees





Effects of diking & channelization
on cottonwood forest structure?

Forest stand surveys

Okanagan River
Mission Creek
Similkameen River
West Kettle River
Ellis Creek
Penticton Creek

River training diked,
channelized, or both

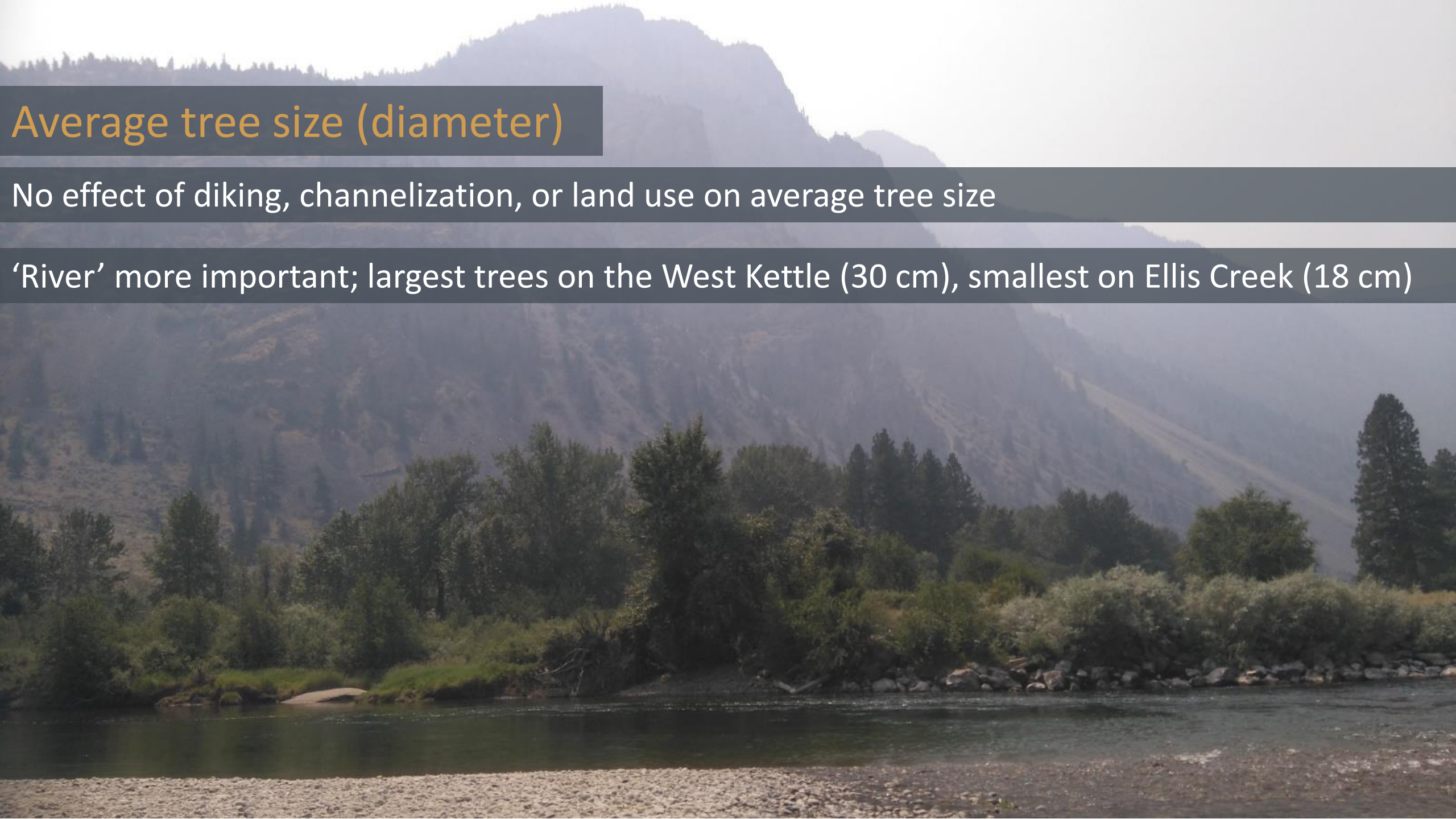
Land use conservation,
agriculture, grazing, or urban



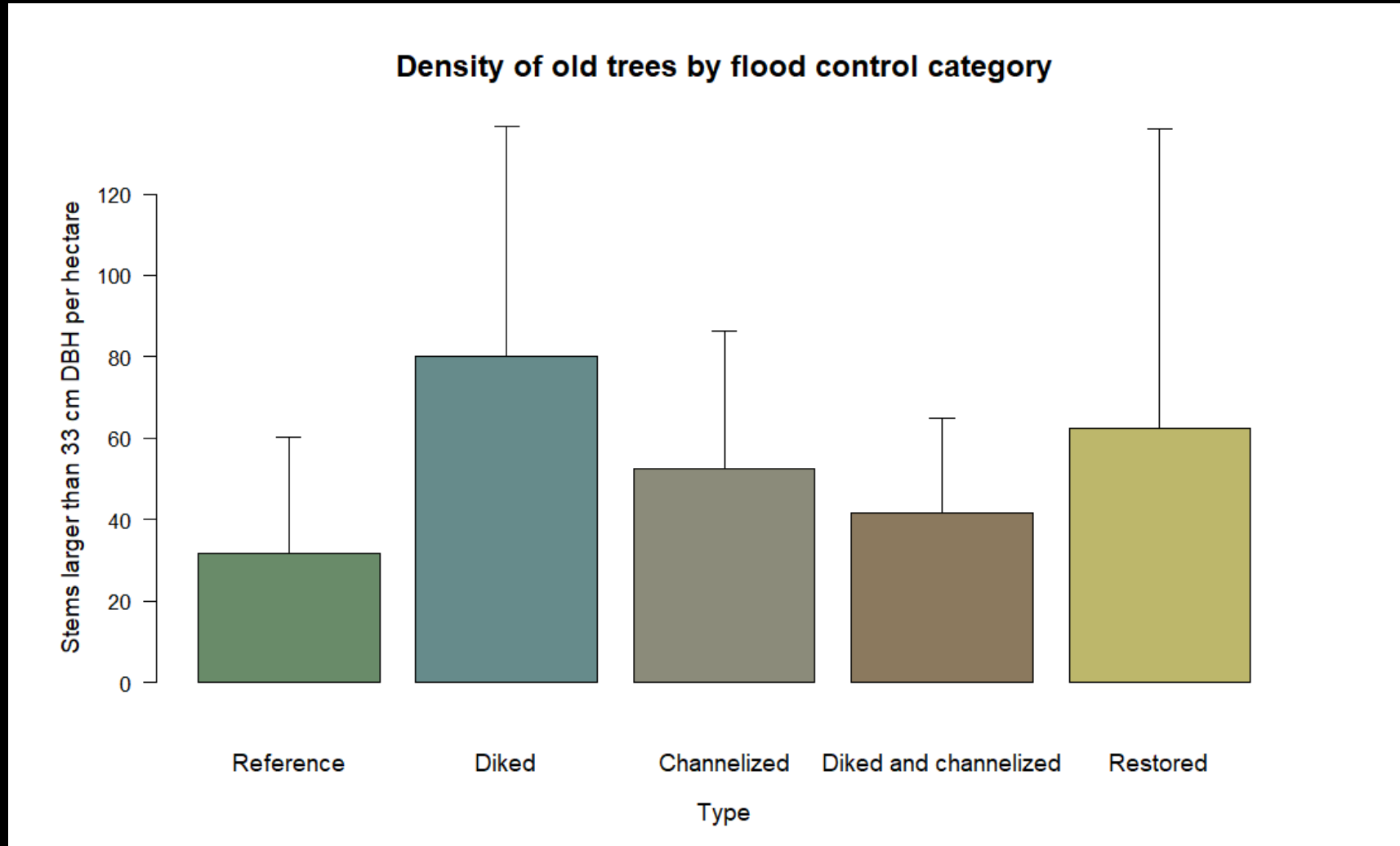
Average tree size (diameter)

No effect of diking, channelization, or land use on average tree size

'River' more important; largest trees on the West Kettle (30 cm), smallest on Ellis Creek (18 cm)

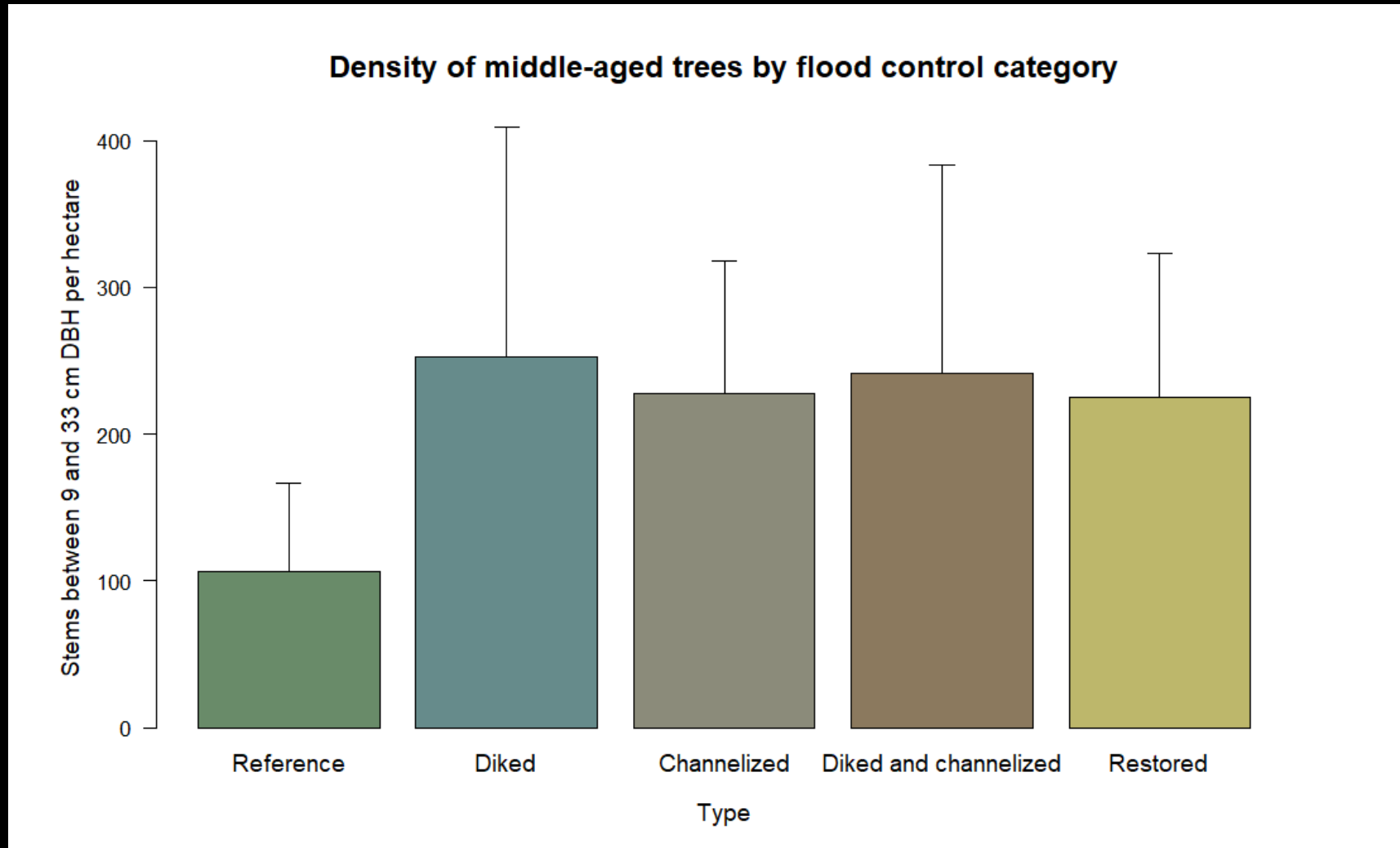


Stem density of large trees (>40 cm diameter)



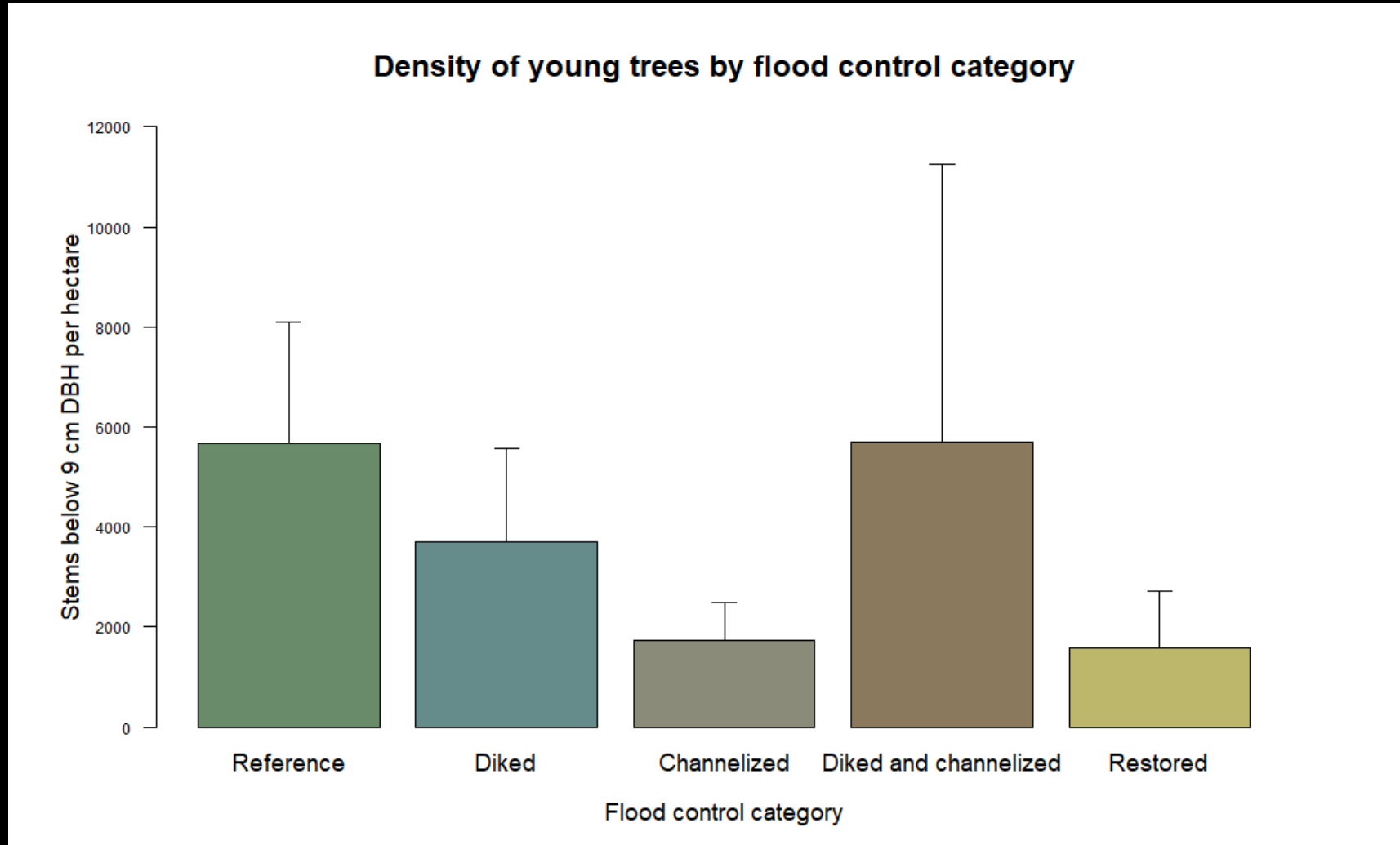
No difference due to river training
Artifact of sampling?

Stem density of mid-sized trees (9-40 cm diameter)



No difference due to river training
Artifact of sampling?

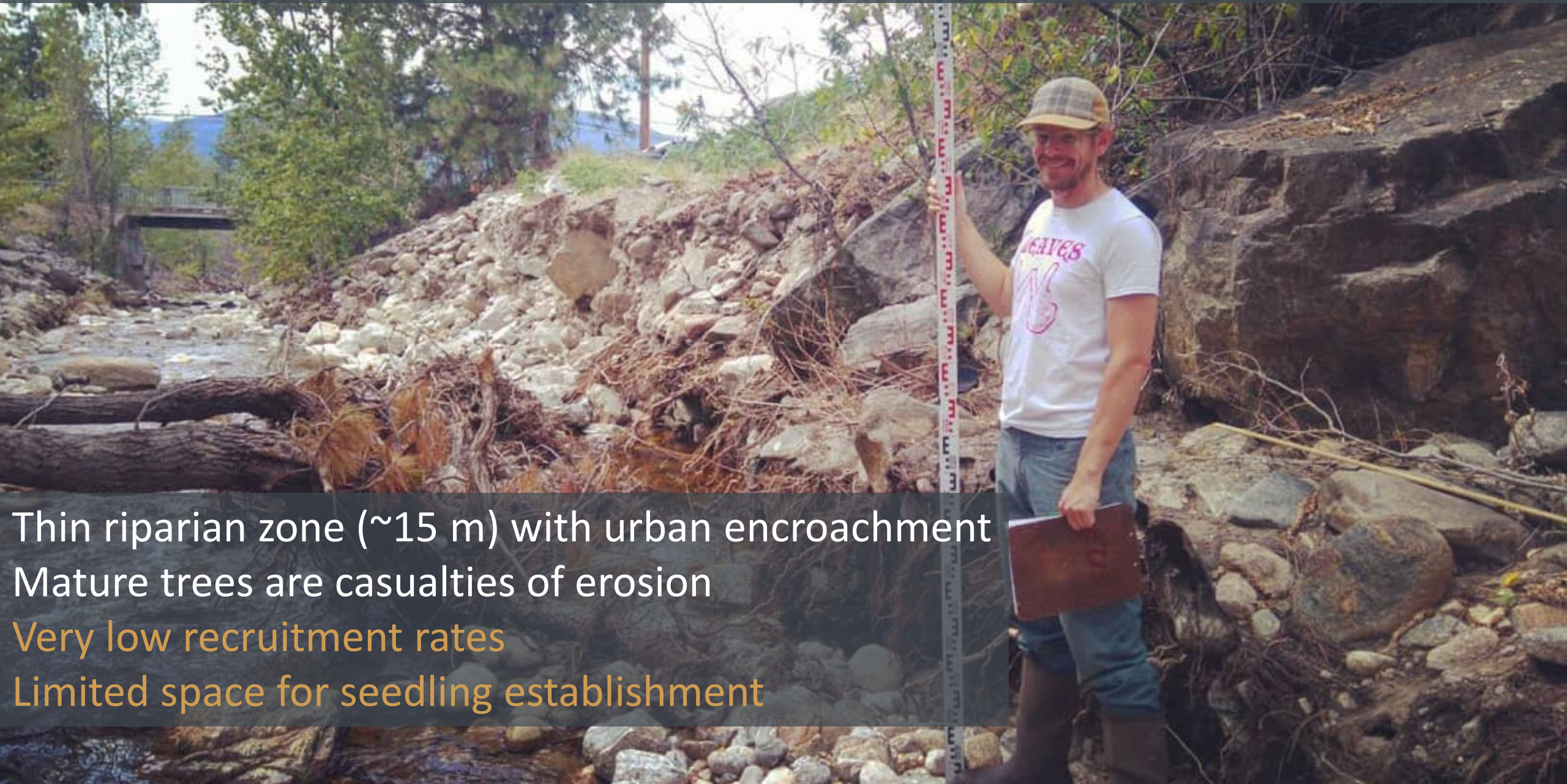
Stem density of new recruits (<9 cm diameter)



5600 stems/ha at reference sites and diked & channelized sites
3800/ha at diked sites

Fewer than 1800 stems/ha at high-gradient channelized sites

Concern about persistence on urban high-gradient channelized streams

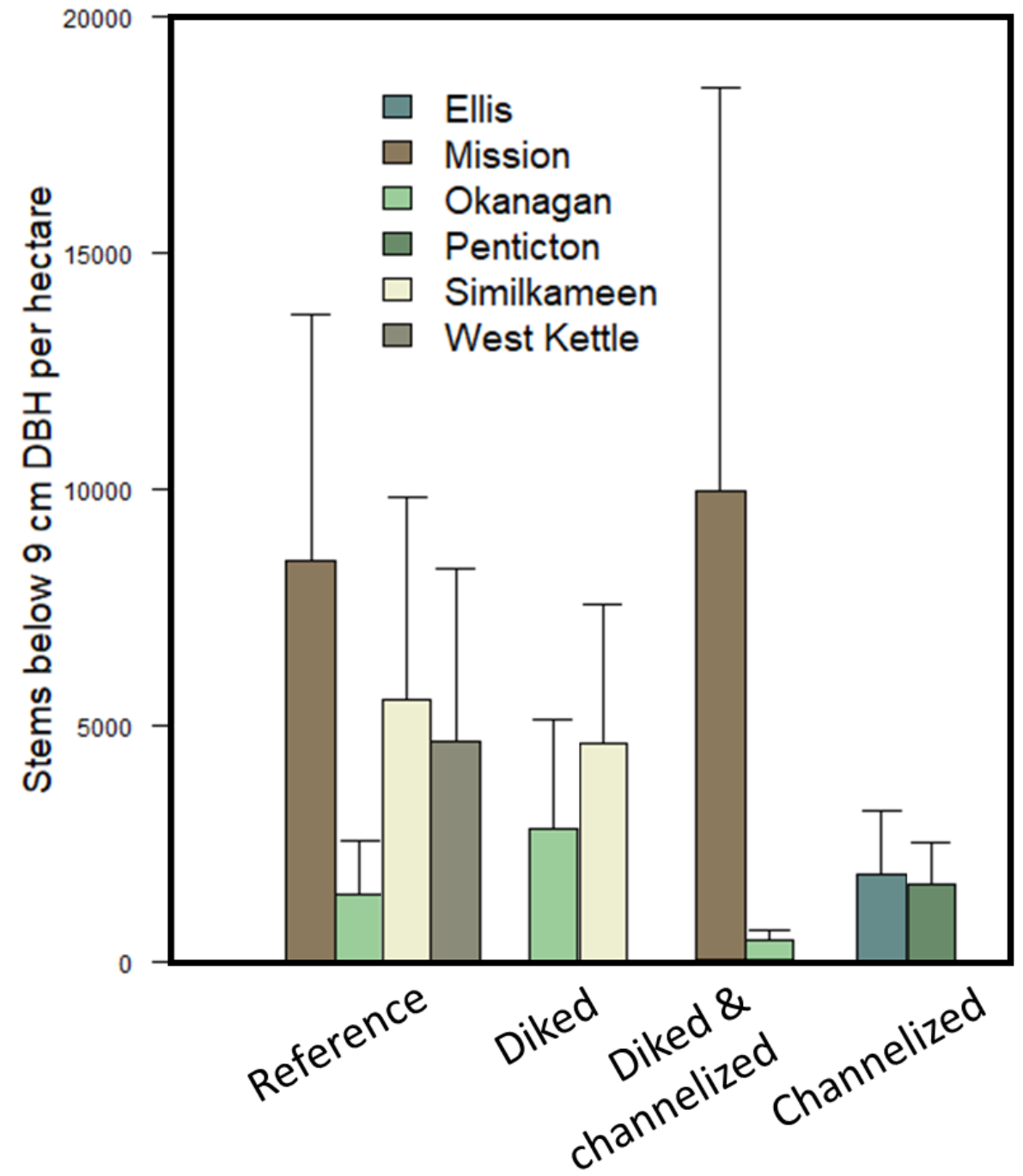


Thin riparian zone (~15 m) with urban encroachment
Mature trees are casualties of erosion
Very low recruitment rates
Limited space for seedling establishment

Stem density of new recruits

Pattern of high density at diked and channelized sites driven by Mission Creek sites

Okanagan River has low recruitment rates compared to other lowland rivers



Diked & channelized sites

Recruitment behind dikes virtually non-existent



Okanagan River
<1000 stems/ha

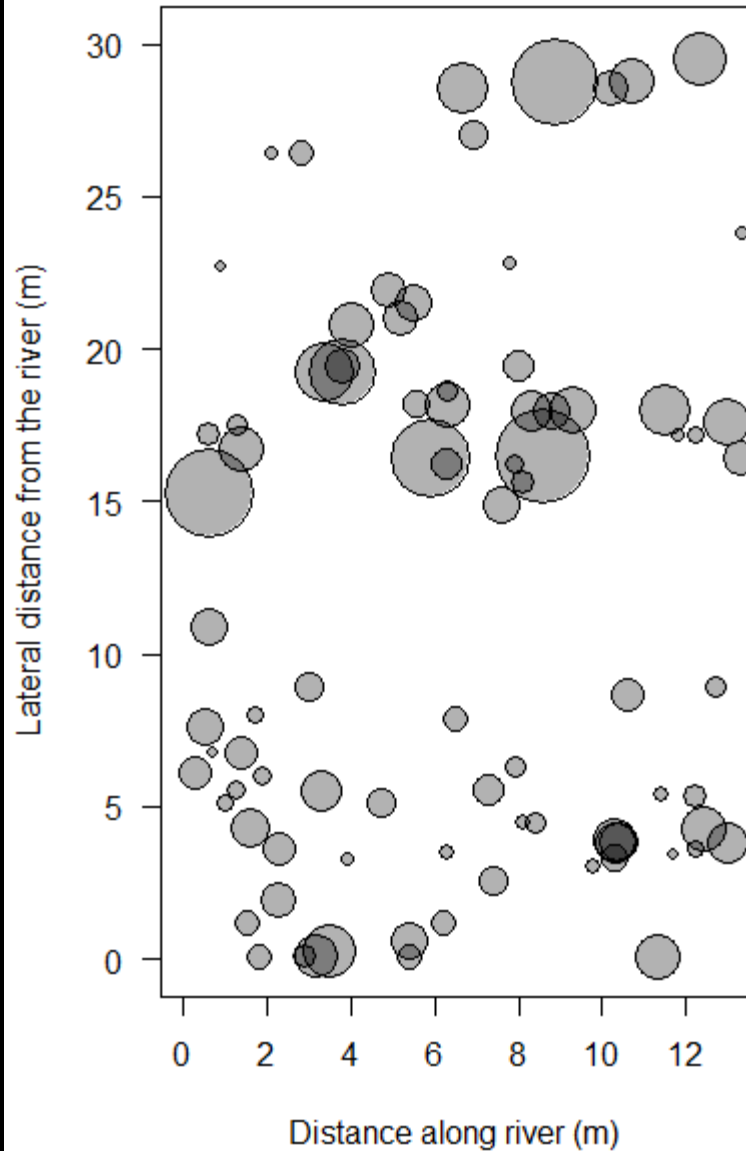


Mission Creek
>11500 stems/ha

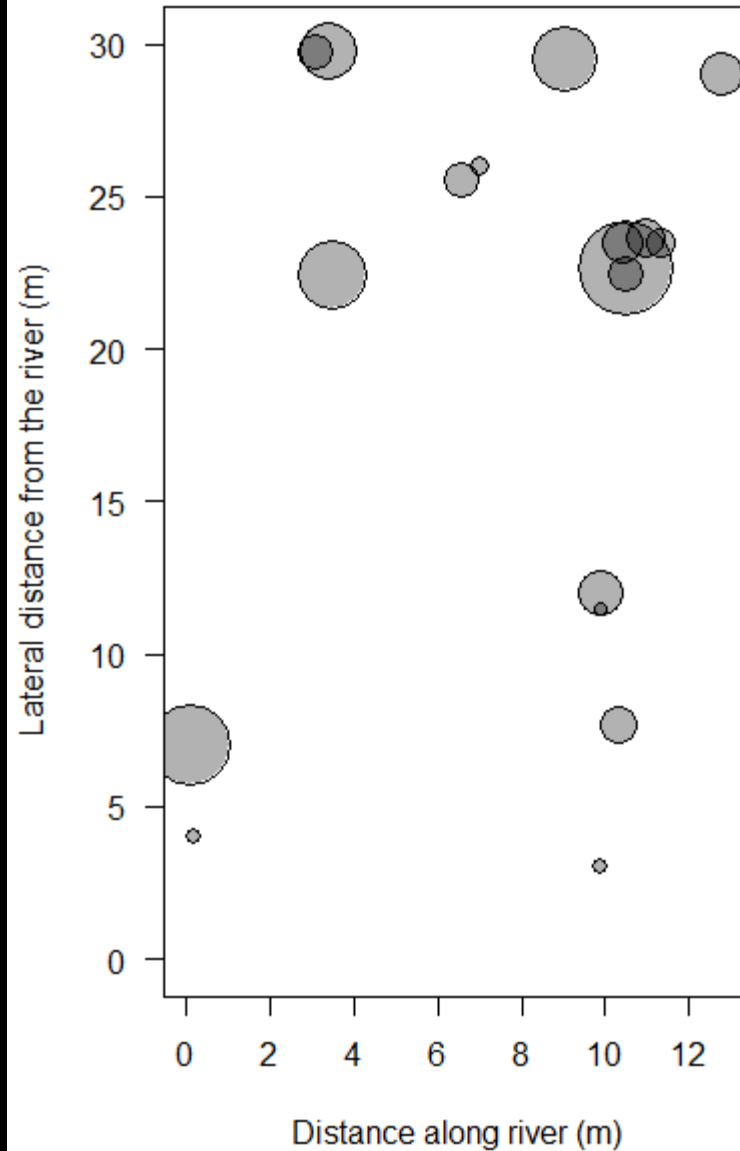
Vegetation management? (Dike Maintenance Act)

Flow regime? Dike shape? Some other factor?

Mission diked and channelized



Okanagan diked and channelized



Concern about
persistence on the
Okanagan River

Can we promote
renewal of
cottonwood forests
while meeting flood
control objectives?

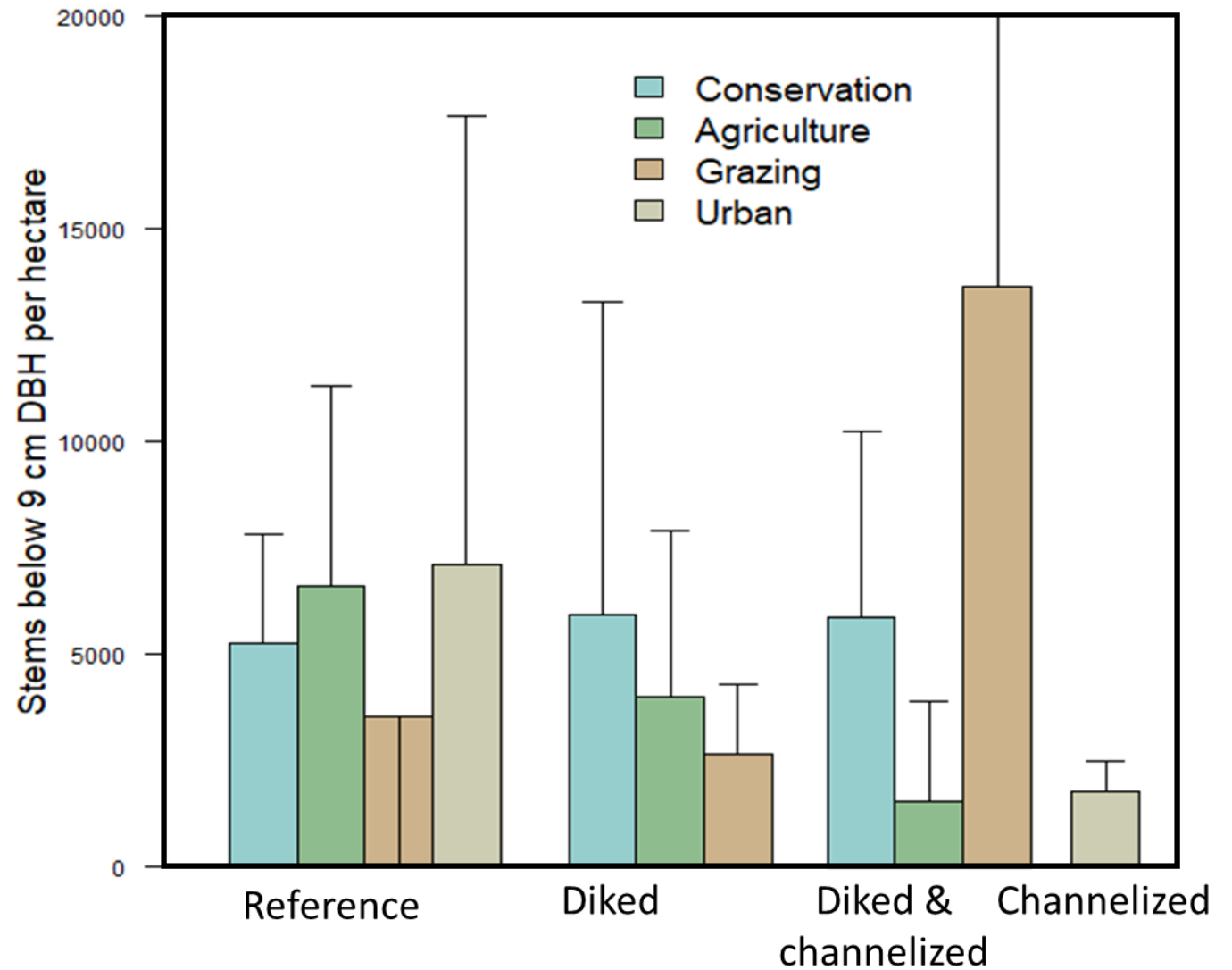
What about in-stream
roles of cottonwood?

Stem density of new recruits

Trees allowed on dikes in conservation areas

Diking & channelization probably facilitate urban and agricultural encroachment

Better exclusion of grazing animals from riparian area when dike is adjacent to river?



Okanagan River, Oliver



Okanagan Nation Alliance Fisheries Department

Restoration

Floodplain re-engagement projects
(dike setback)

Recruitment expected to improve

So far, recruitment rates are low

Mission Creek, Kelowna



Mission Creek Restoration Initiative

Okanagan River Restoration Initiative

Adaptive management
Increased floodplain engagement & planting trials





Community to Community Growing Strong Together Cottonwood Restoration Project

Planting done in Fall 2017
73% survived the winter
17% of trees survived the first year

Further monitoring planned for 2019 and 2020



Cuttings

19% survived

Harvest thick stems

Plant close to the low
water table



Seedlings

8% survived

Plant close to the annual low water mark

Choose an early autumn planting date

Plant on a warm day

Elevation of trees relative to water table
had the biggest effect on survival



Tree elevation

Water table

Planning for persistence means protecting existing cottonwood stands



and designing restoration projects to include appropriate topography, flow regime, and sediment dynamics for cottonwood reproduction

Coexistence requires that we go further:



consider the roles of cottonwood as an ecosystem engineer and a foundation species in both aquatic and terrestrial contexts





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Thank you
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