Modeling Yellow-billed Cuckoo Habitat Change from 1952 and 1987 on the Sacramento River (RM 155-234)

Photo by James Gallagher

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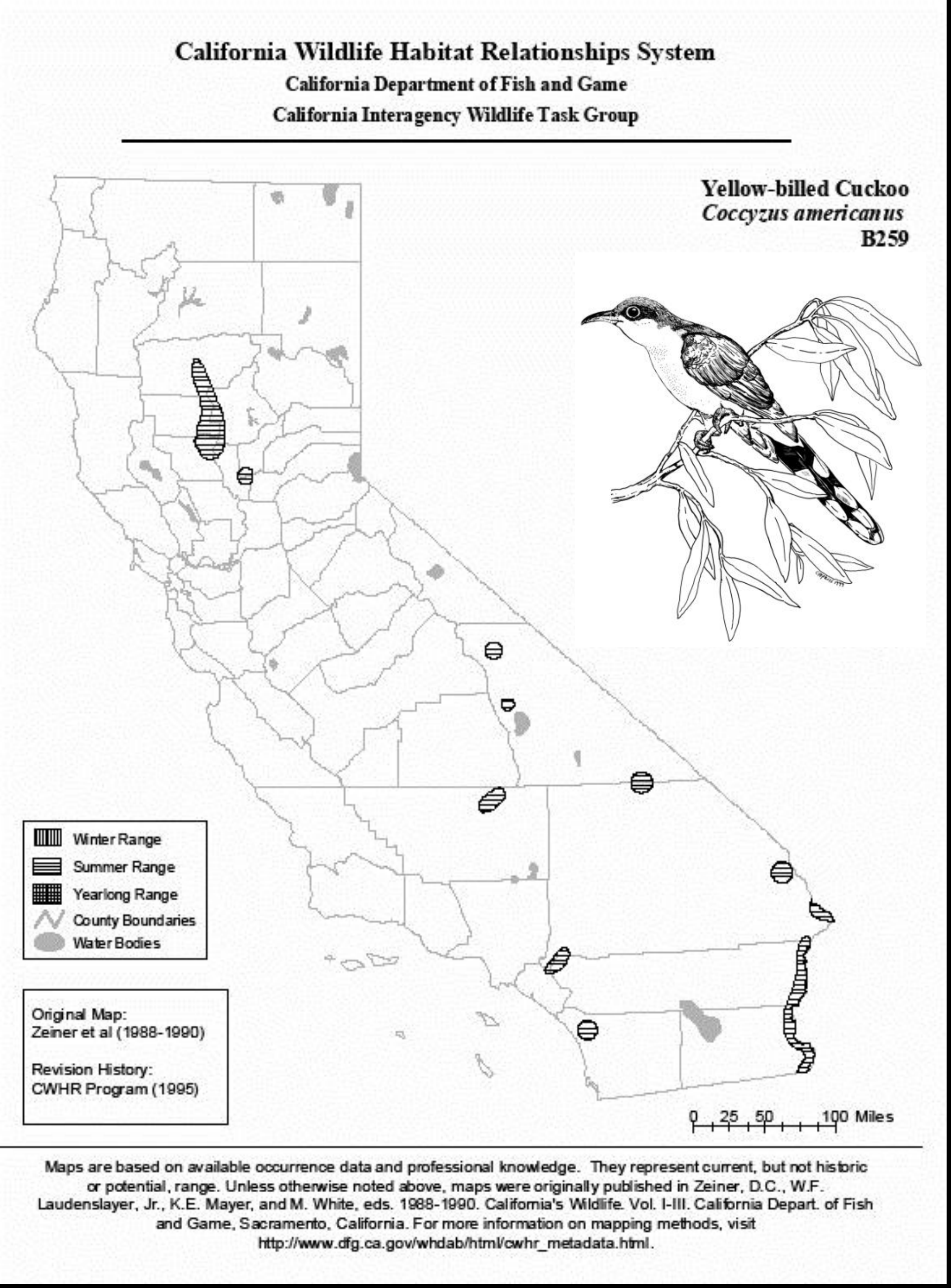


Yellow-billed Cuckoo

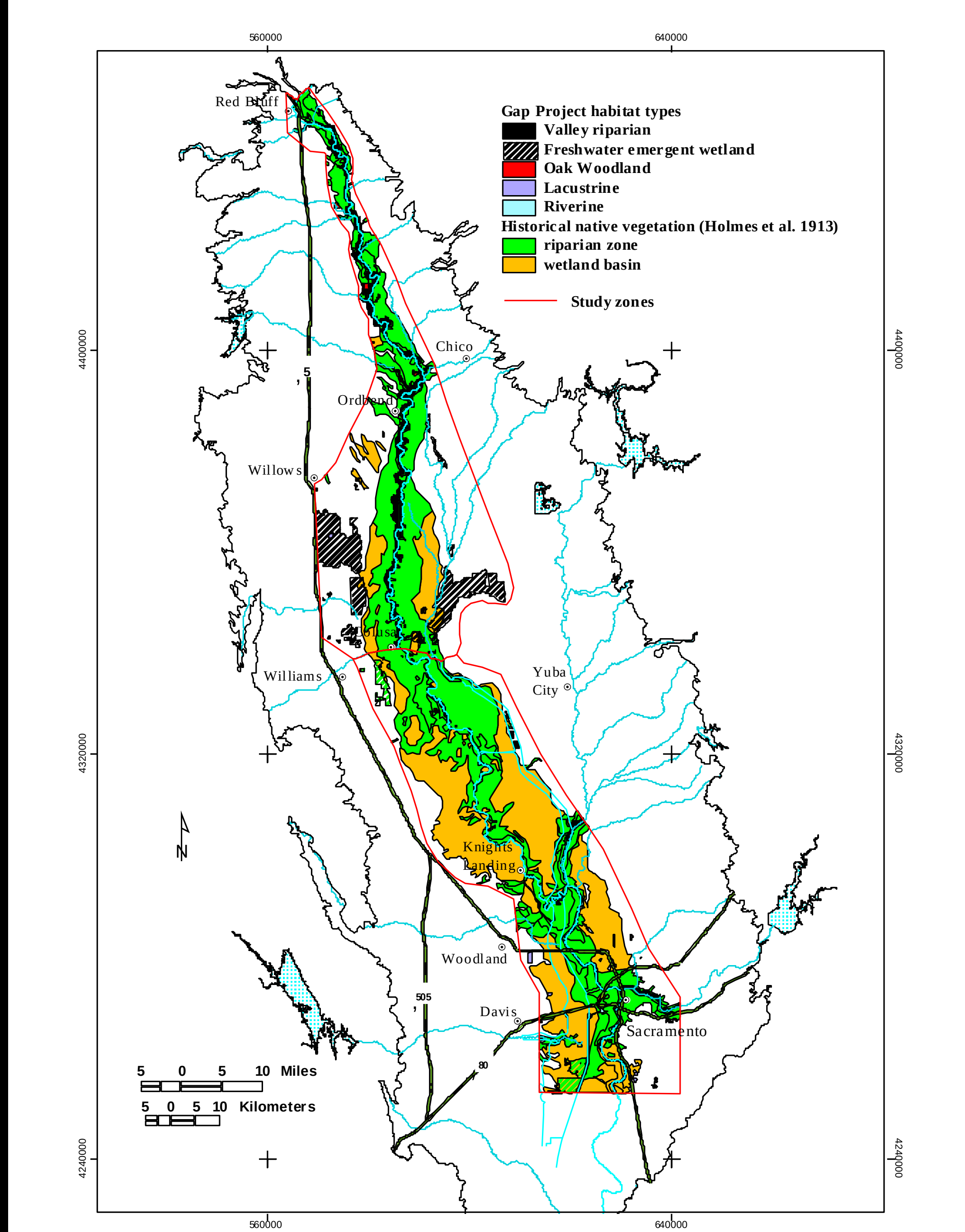
(*Coccyzus americanus*)

- Belding (1890) noted it was a common bird in the Central Valley
- Statewide
  - late 1800s: ~15,000 pairs
  - 1977: ~163 pairs
  - 2000: ~100 pairs
- Sacramento River population
  - 1973: ~96 pairs
  - 1977: ~60 pairs
  - 1987-1990: ~35 pairs
  - 1999-2000: ~40 pairs

From: Hughes 1999, Gaines 1974,
Gaines and Laymon 1984, Halterman 1991, Halterman et al. 2000

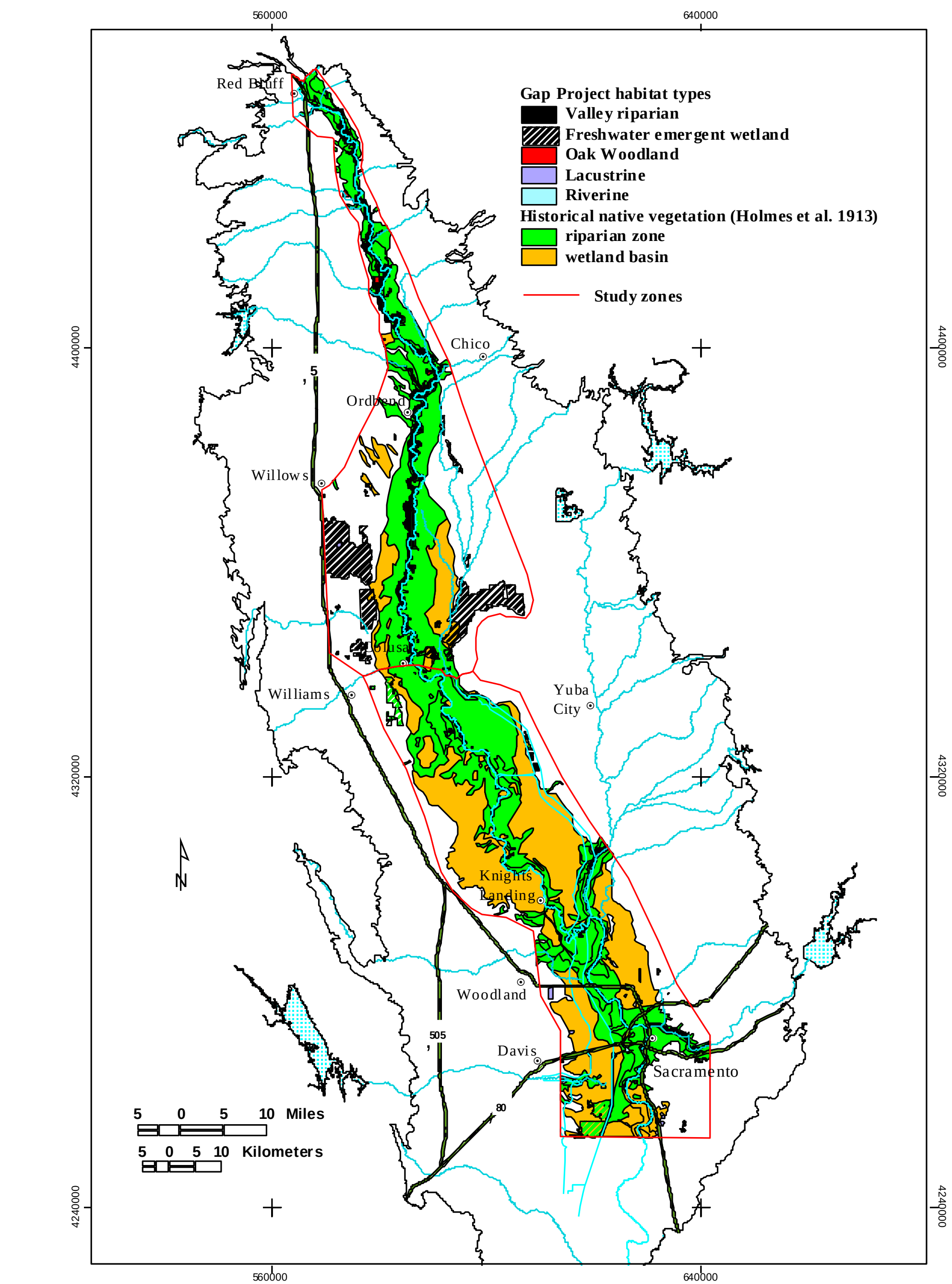
illustration by C. Hipkiss

RIPARIAN VEGETATION



From: Greco 1999

RIPARIAN VEGETATION



8% remains overall

~380,000 ac: Historical
~30,000 ac: Today

From: Greco 1999

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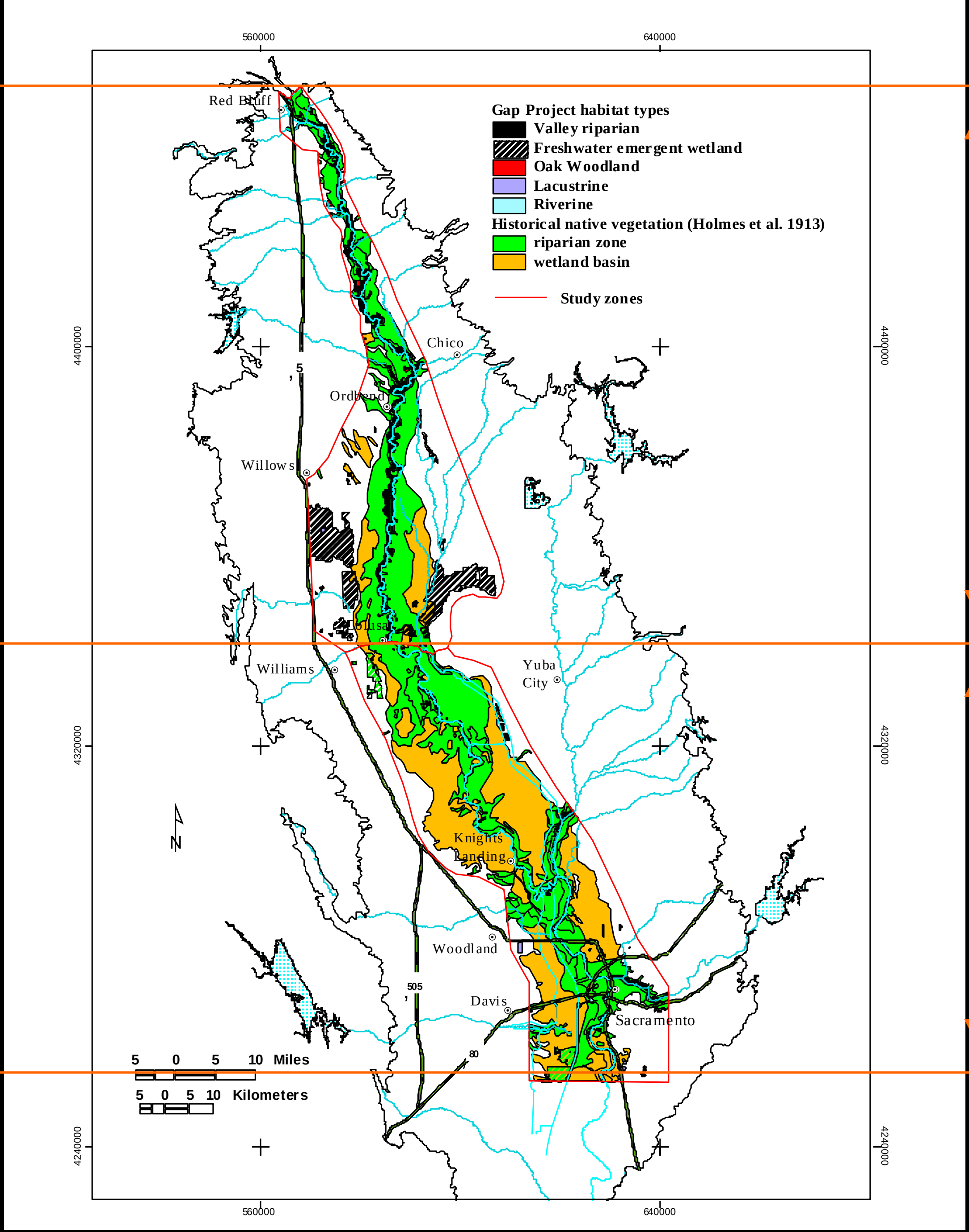
~30,000 ac: Today



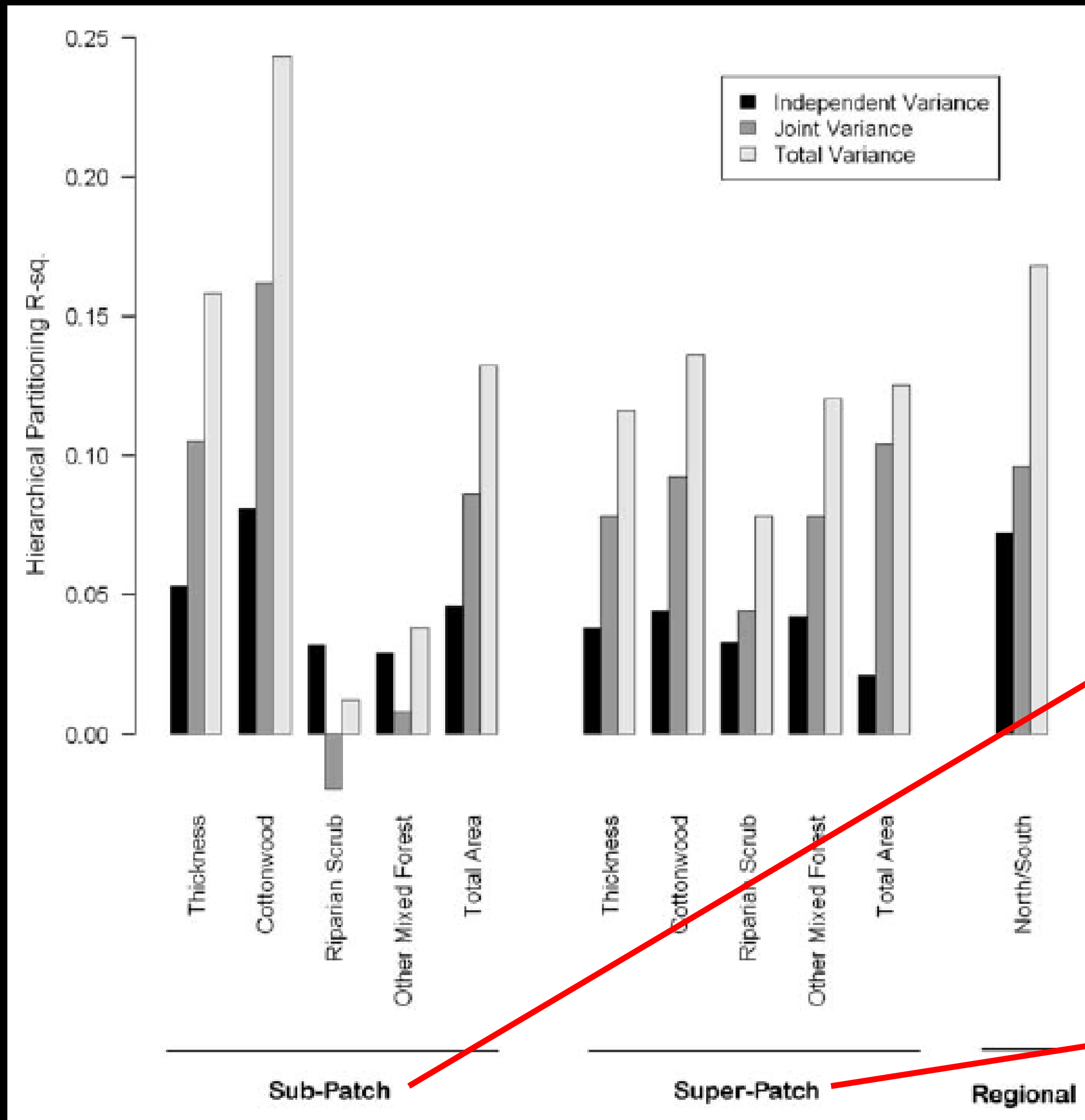
16% remains from Red Bluff to Colusa

2% remains from Colusa to Sacramento

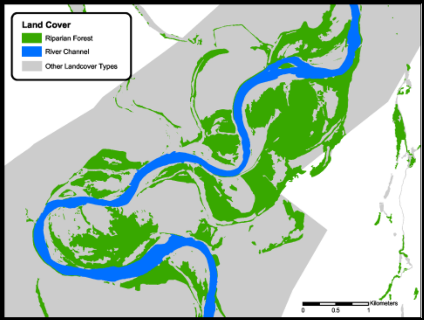
From: Greco 1999

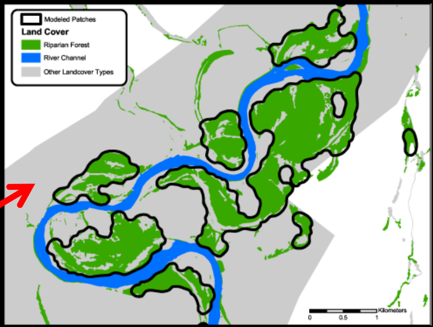
Results from logistic regression hierarchical partitioning analysis:

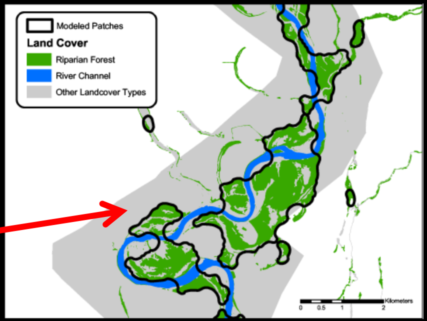
% Variance explained by each variable



Girvetz and Greco (2007): PatchMorph Algorithm







Girvetz, E. H., and S. E. Greco. 2009. Multi-scale predictive habitat suitability modeling based on hierarchically delineated patches: an example for yellow-billed cuckoos nesting in riparian forests, California, USA. ***Landscape Ecology*** 24(10):1315–1329

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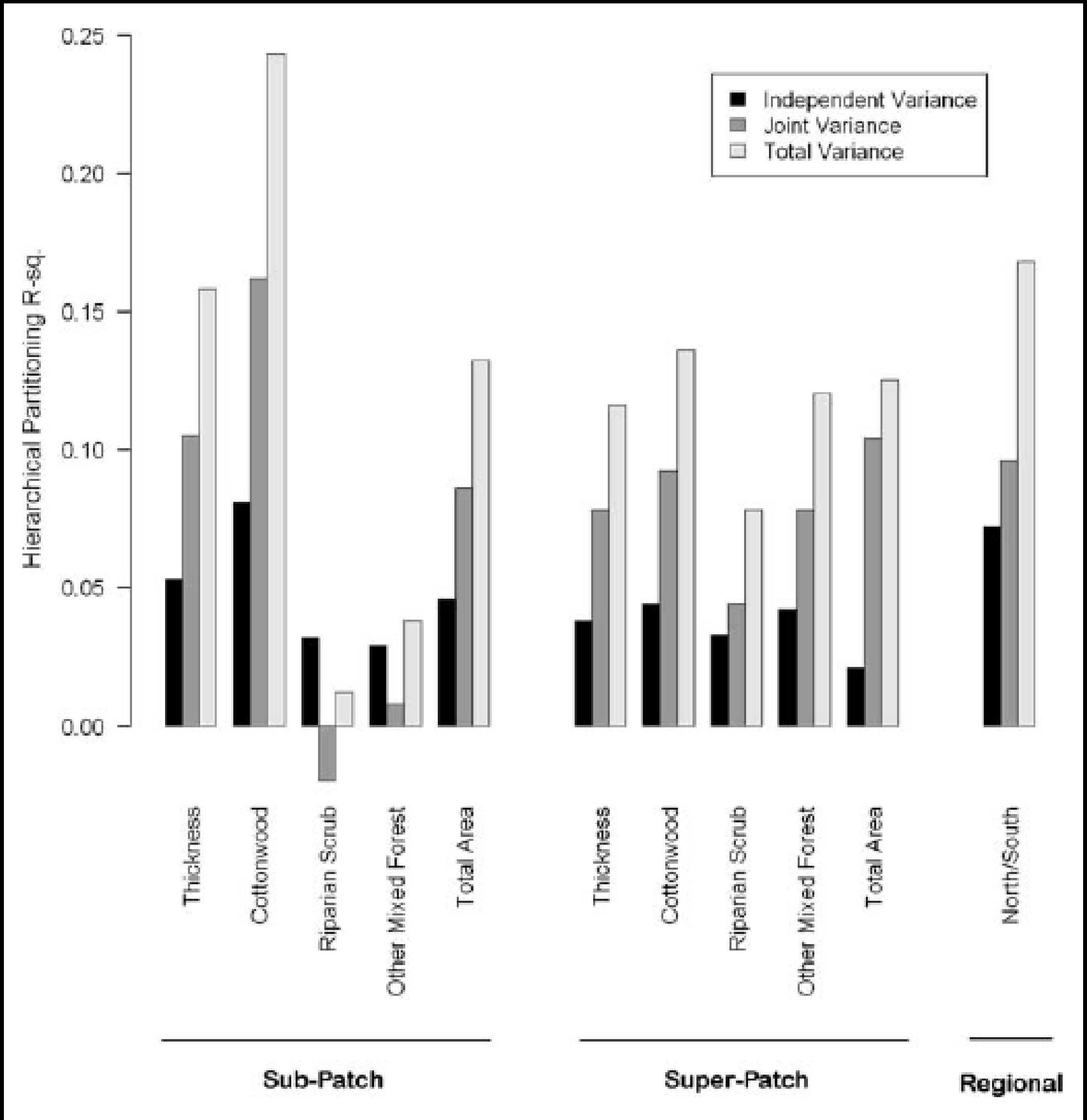

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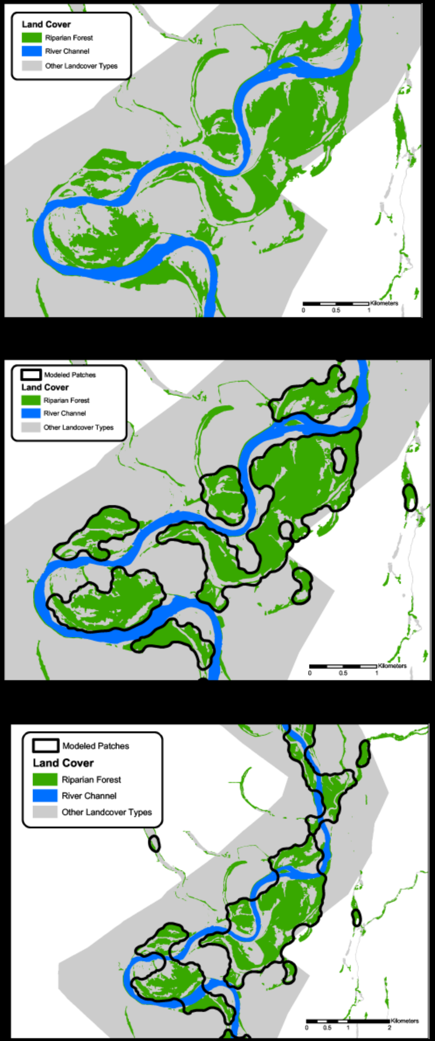

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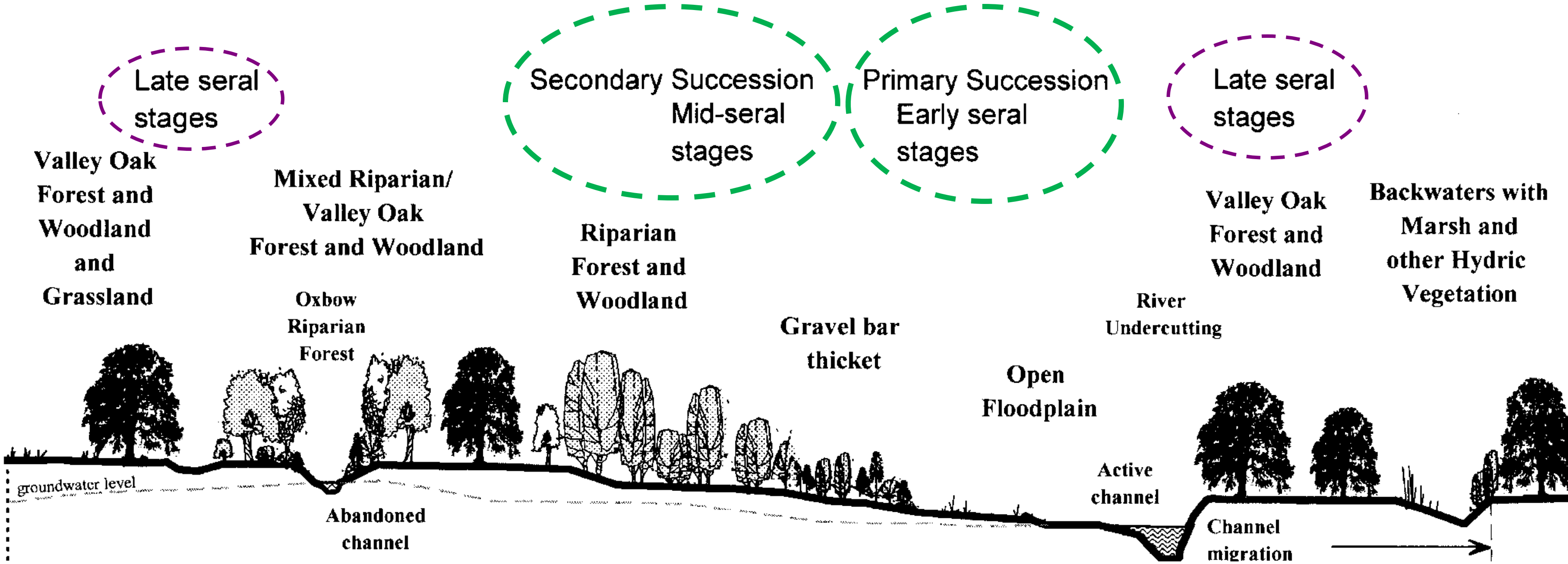
Riparian Landscape Structure and Composition:



An idealized toposequence of riparian plant communities in the Sacramento Valley (adapted from Conard et al. 1980).

Vaghti, M. G. and S. E. Greco. 2007. Riparian Vegetation of the Great Valley.
IN: Barbour, M. G., T. Keeler-Wolf and A. Schoenherr (Eds.)
Terrestrial Vegetation of California, 3rd ed., UC Press, Berkeley, CA, pp. 425-455.

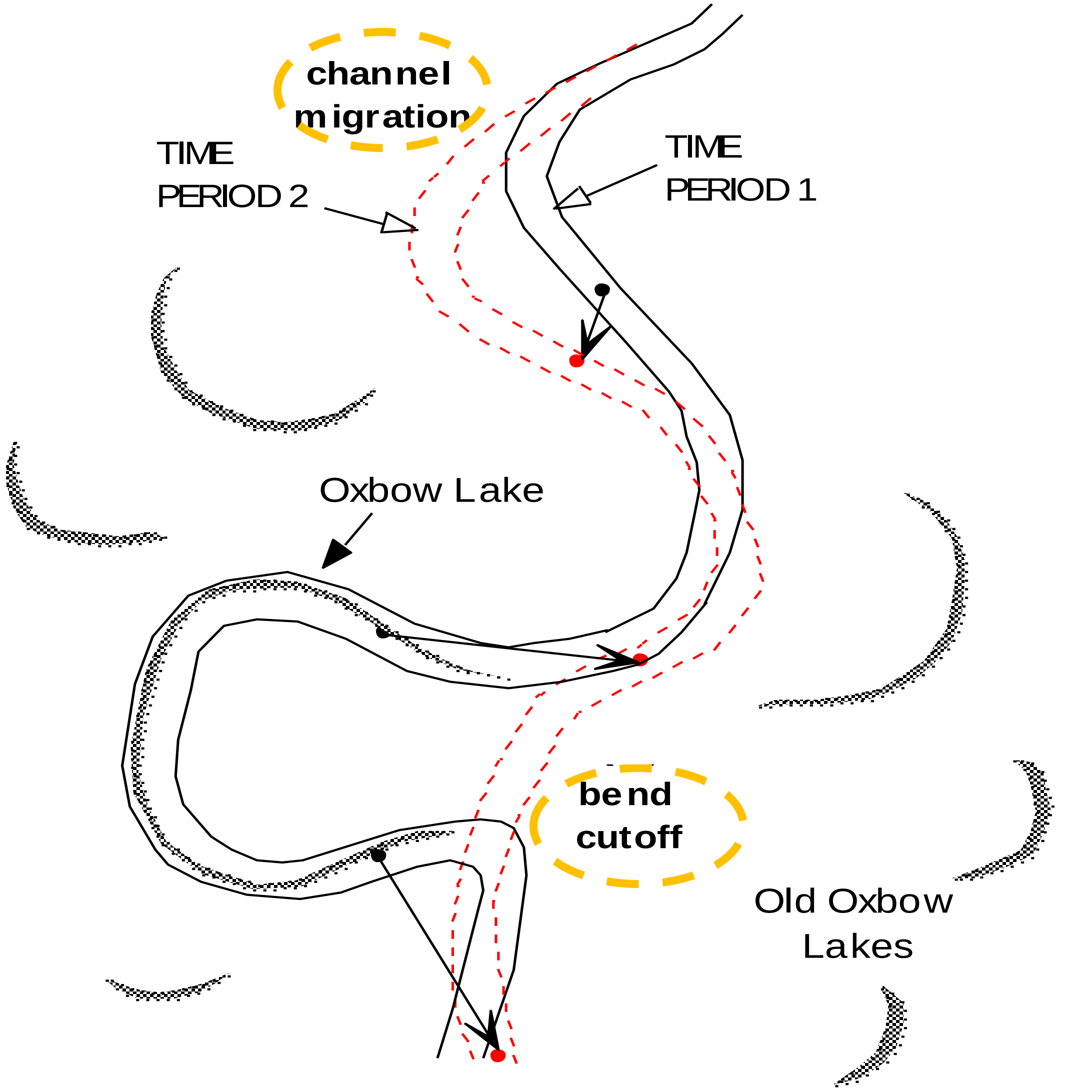


FIGURE 3.1: Two time periods depicting river meander dynamics: (a) la
channel migration, note point bar development on the upp
bend, and (b) channel cutoff on the lower bend forms an
oxbow lake. Channel inflection points are also mapped
between the time periods.

Greco 1999


Photo by Geoff Fricker

Constraints on natural processes:

Shasta Dam

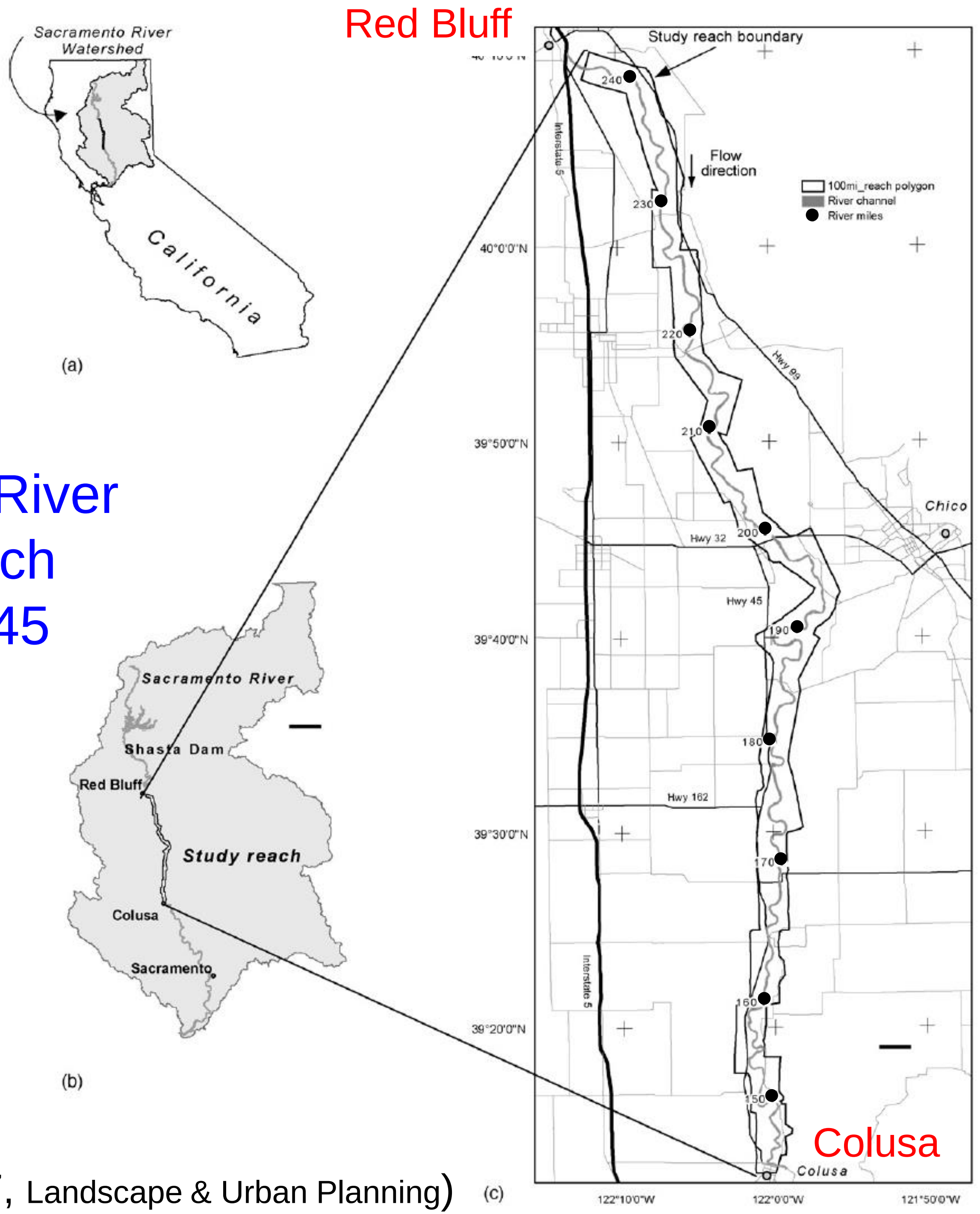
Diversion dams

Levees

Riprap

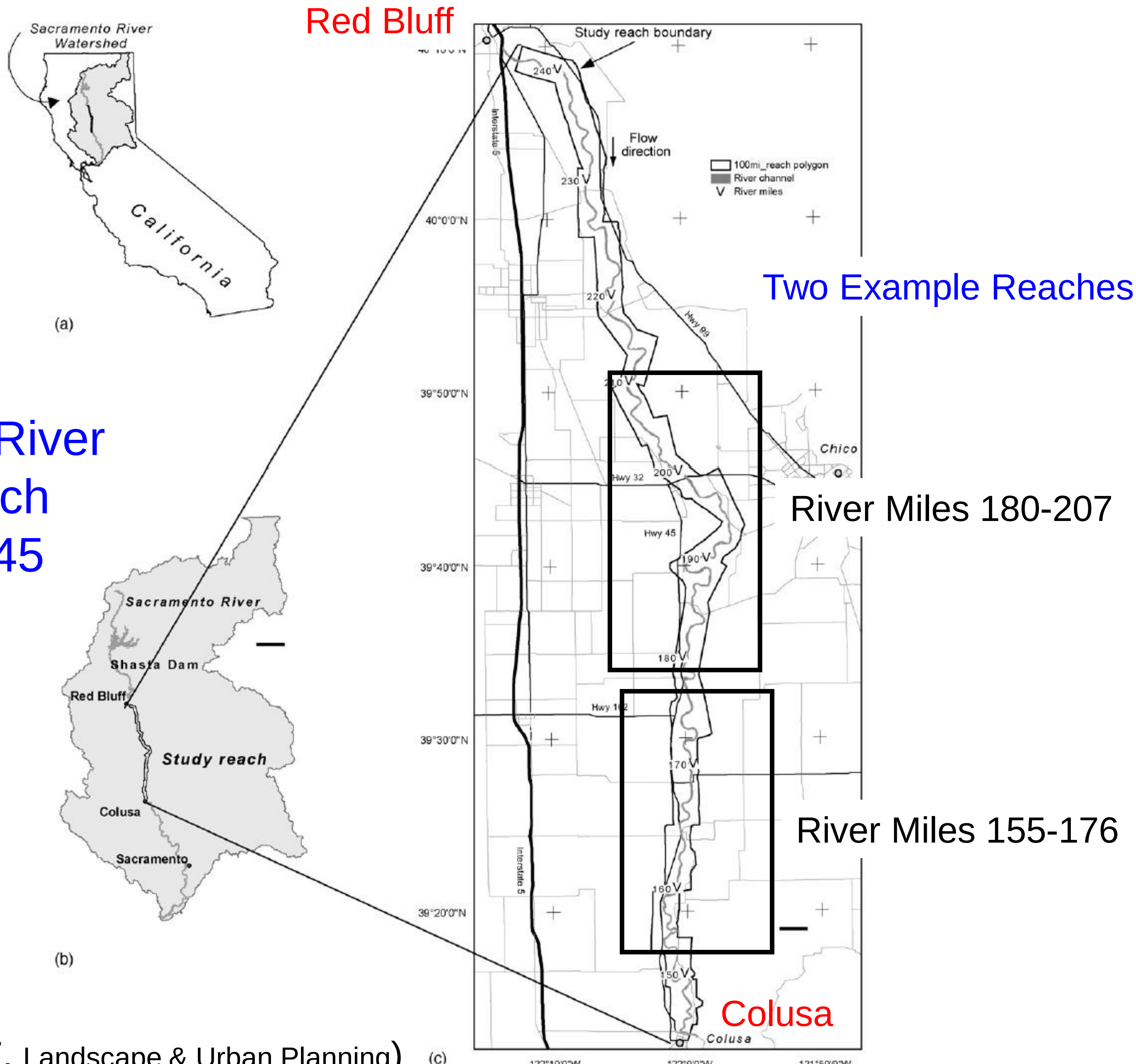
Photos by S. Greco

Sacramento River
Study Reach
RM 144-245



(Greco et al. 2007, Landscape & Urban Planning)

Sacramento River Study Reach RM 144-245



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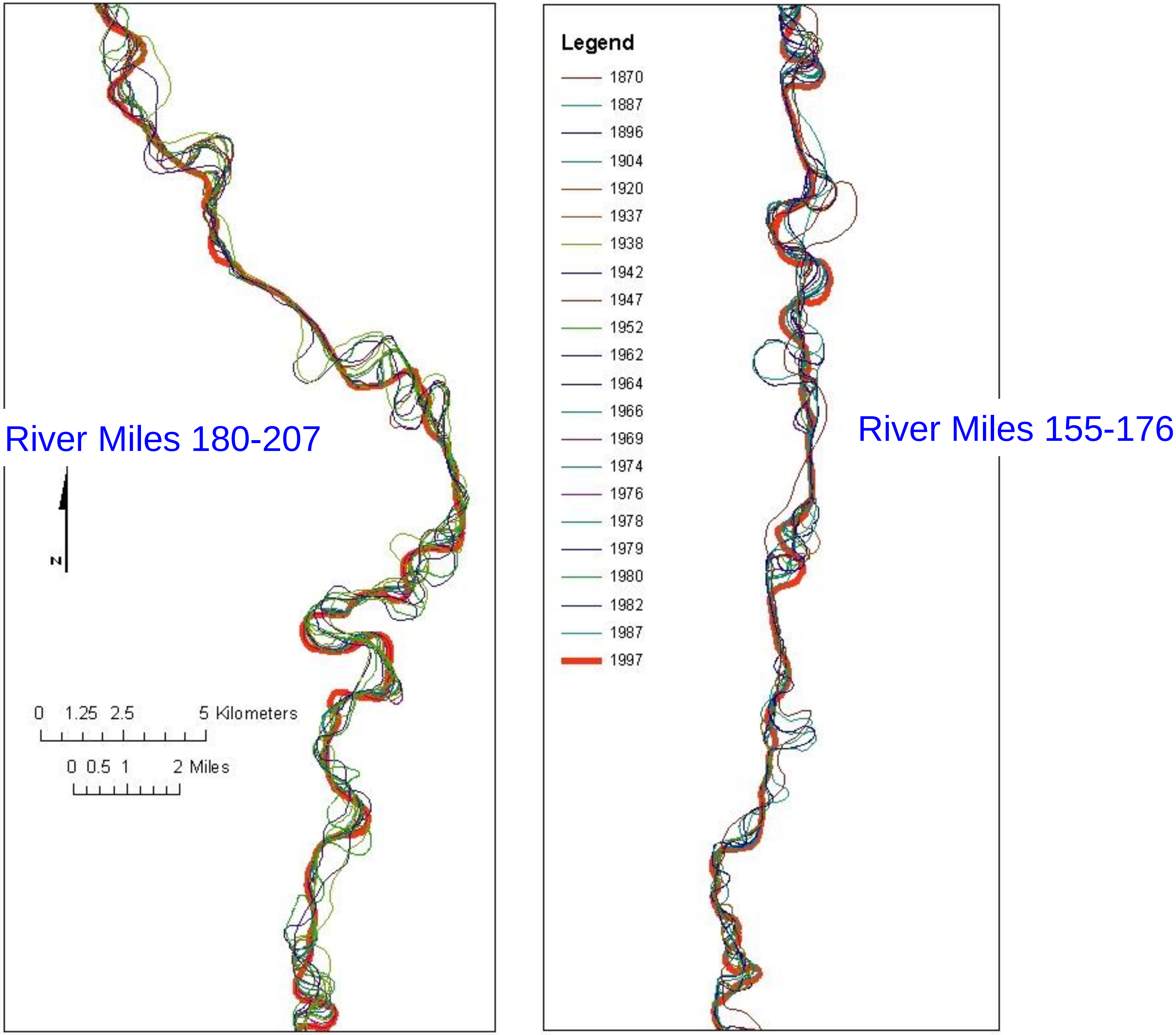
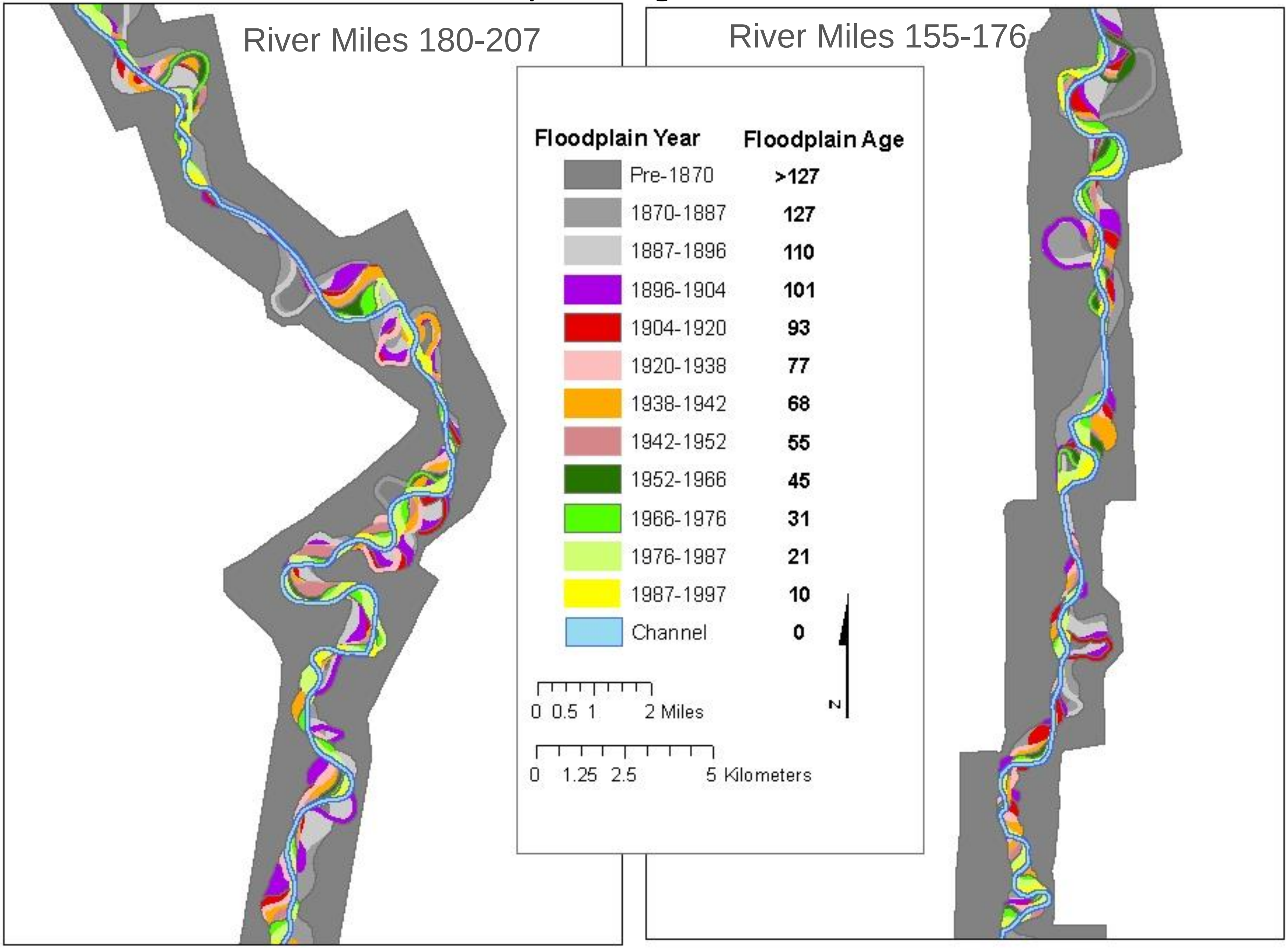
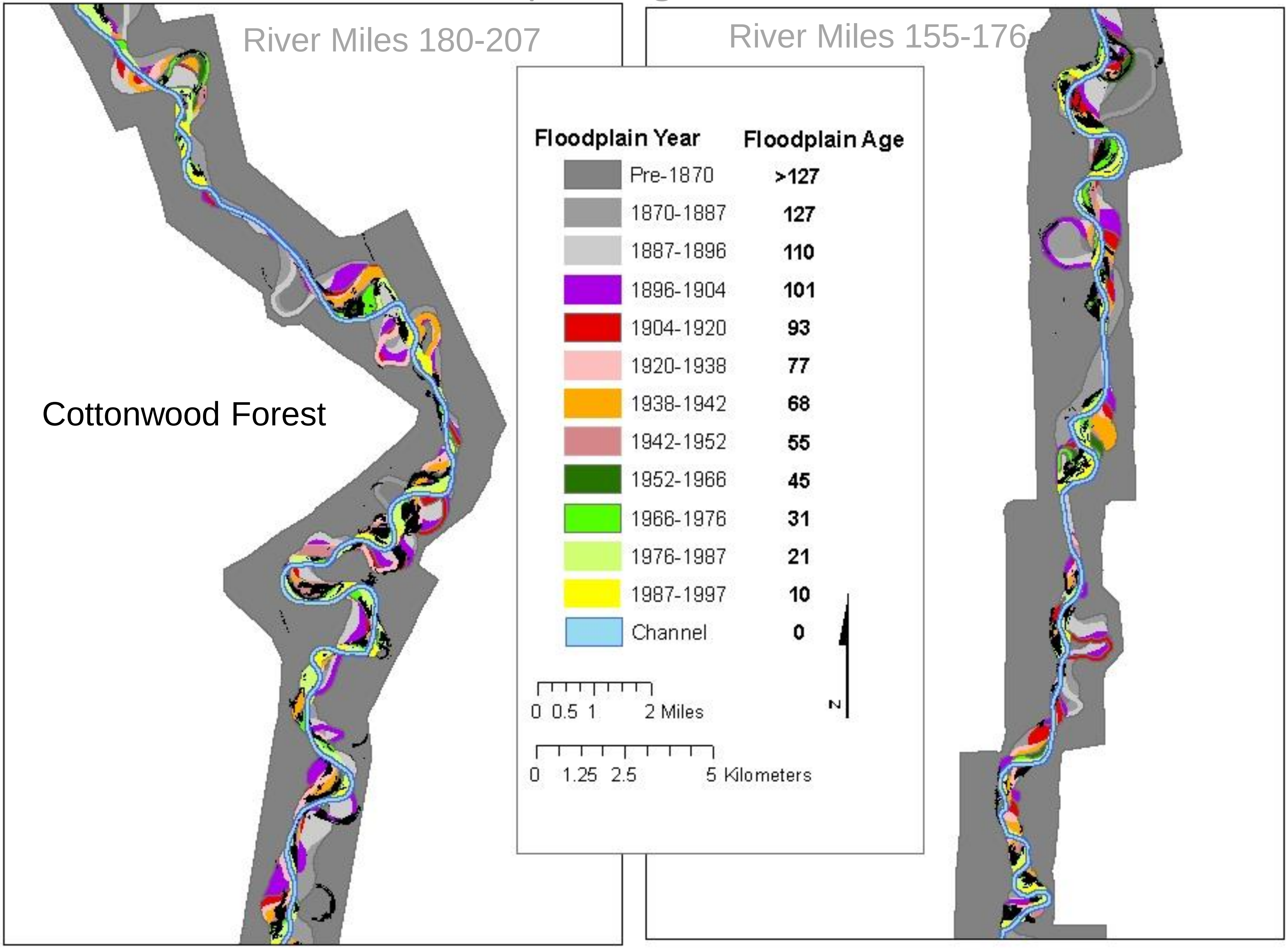


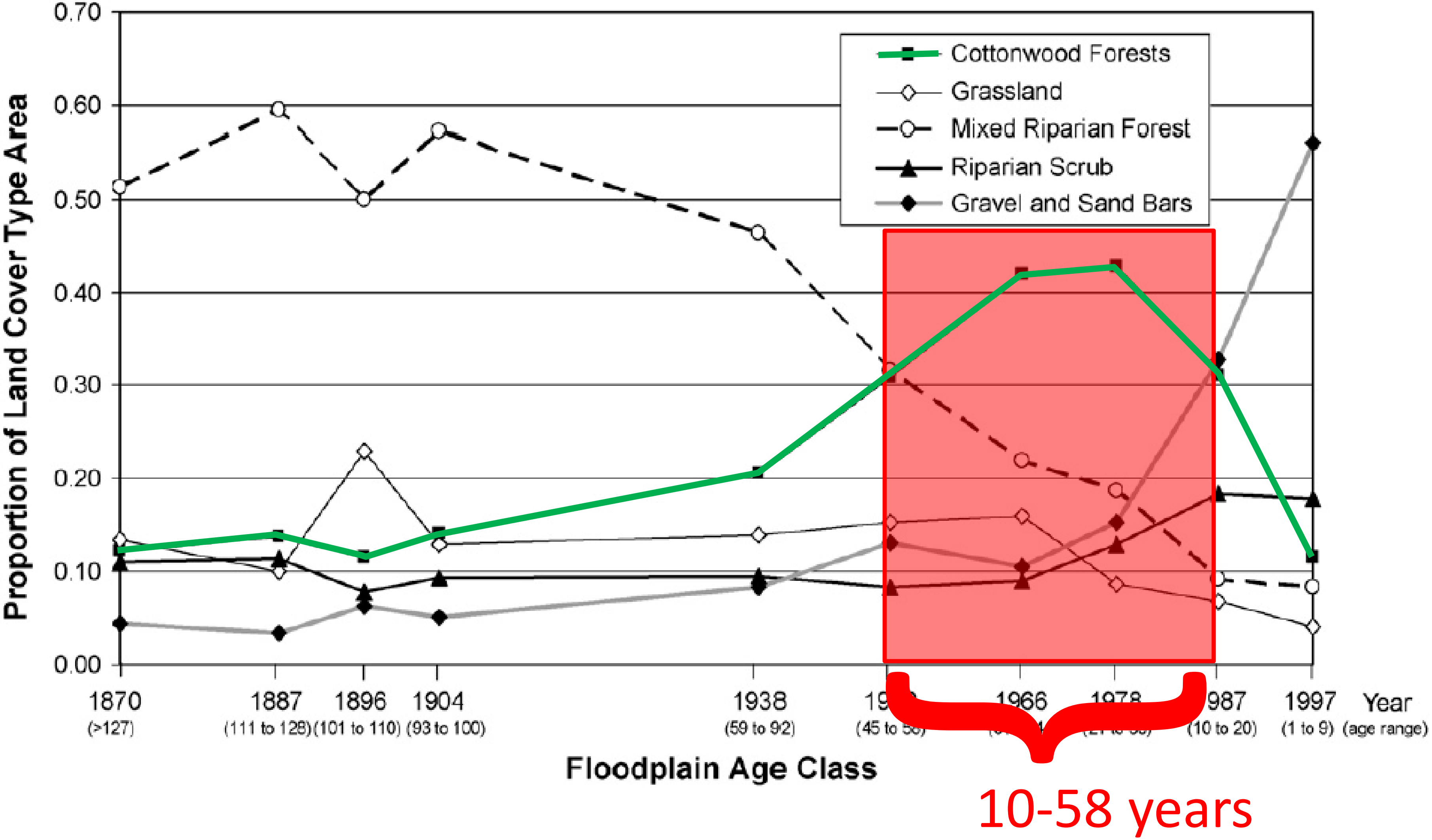
(see Greco and Alford 2003)

Floodplain Age Surface



Floodplain Age Surface

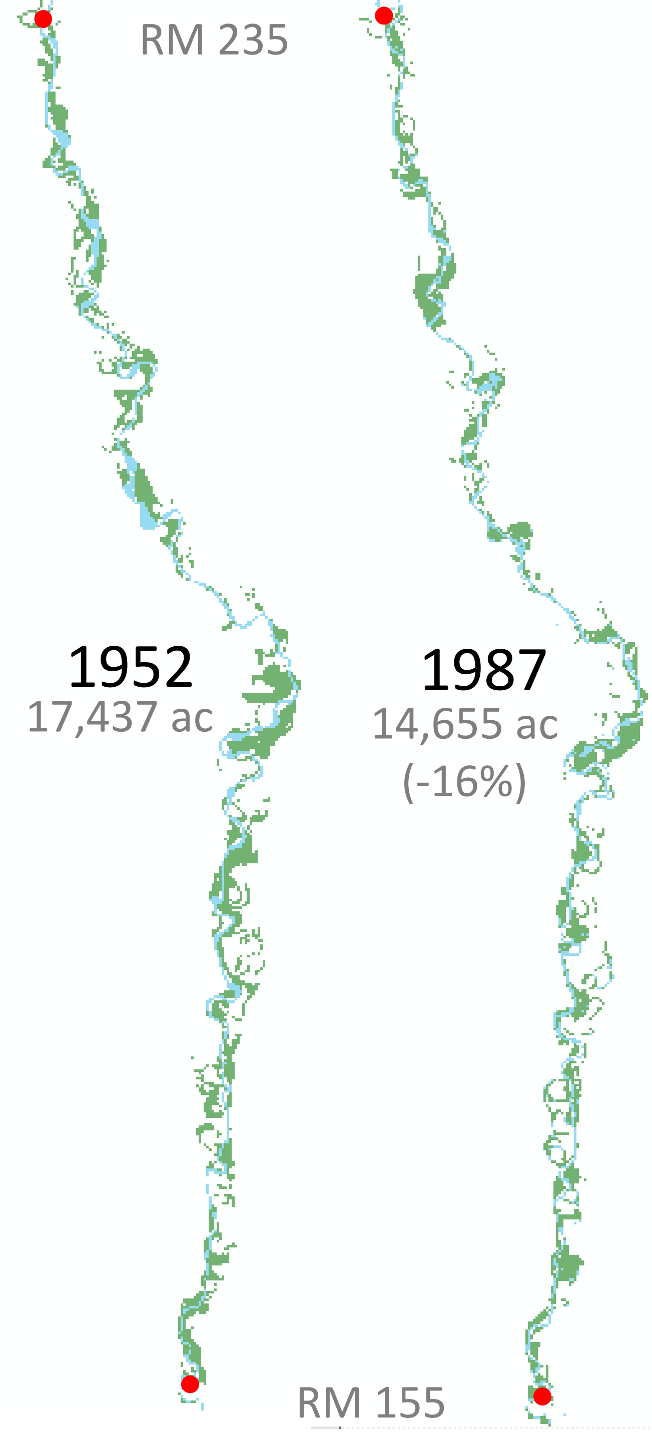




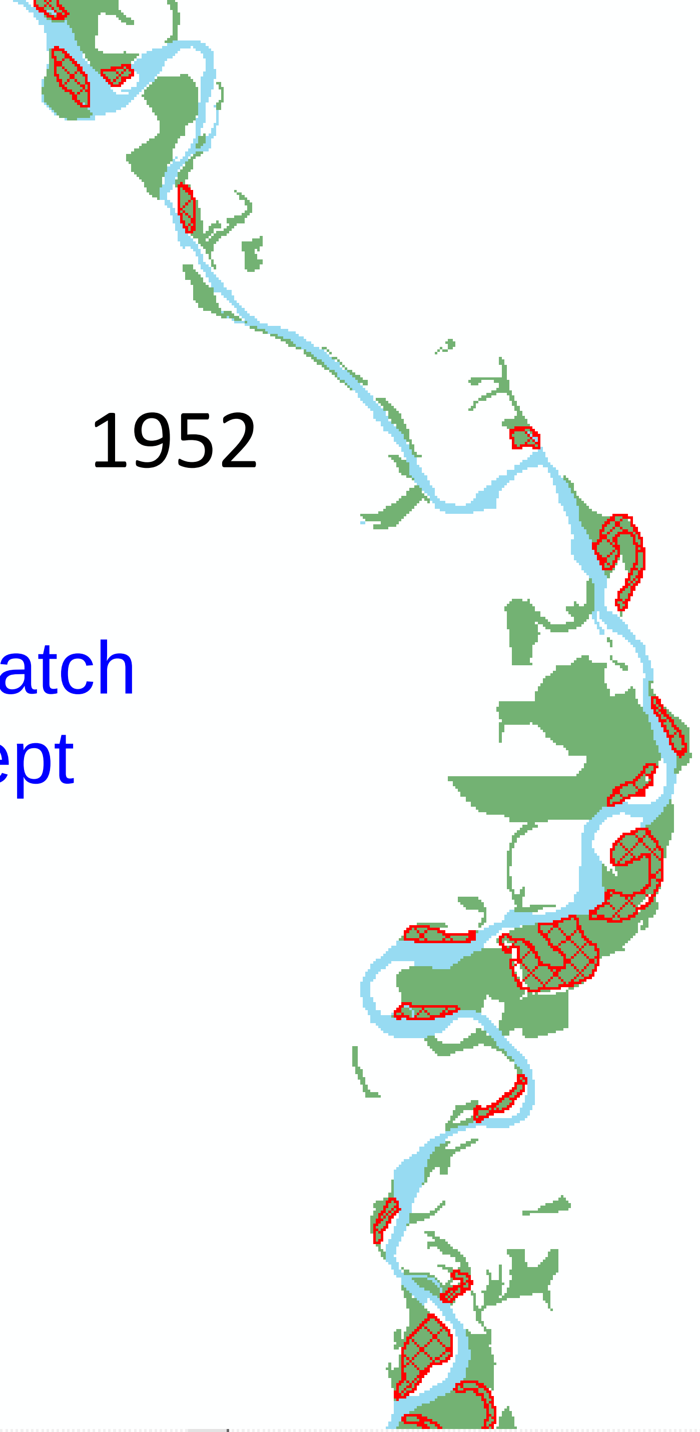
From: Greco, S.E., A.K. Fremier, R.E. Plant, and E.W. Larsen. 2007. A tool for tracking floodplain age land surface patterns on a large meandering river with applications for ecological planning and restoration design. *Landscape and Urban Planning* 81(4):354-373

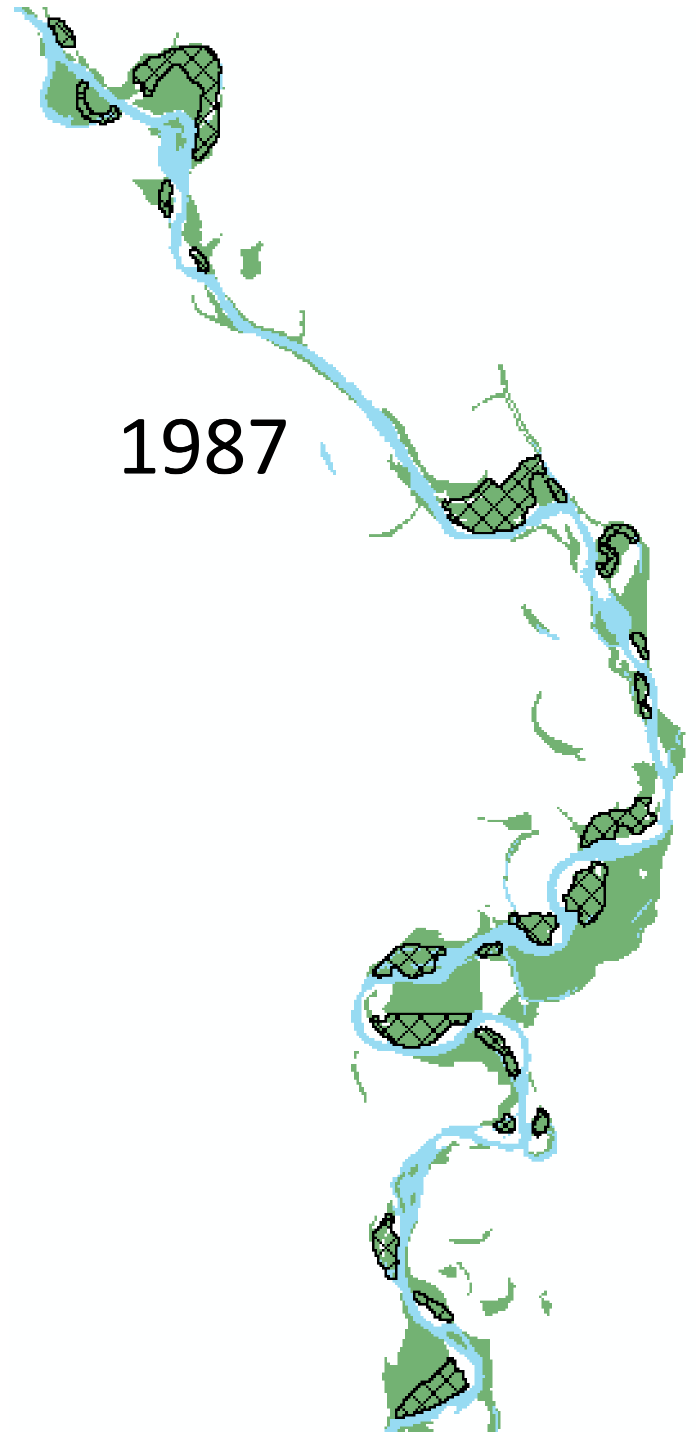
Shifting Mosaic Analysis

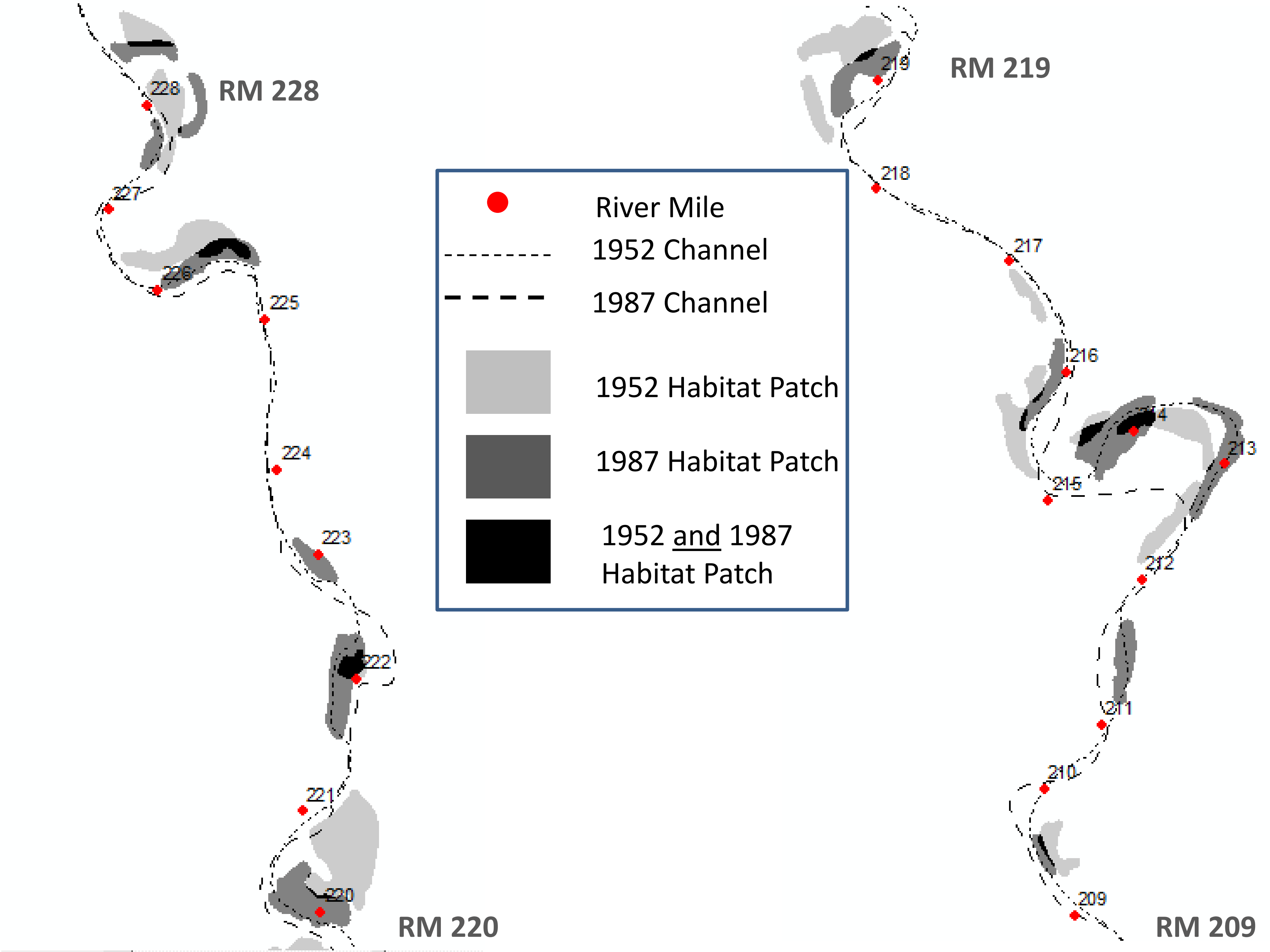
- Study area RM 155-235
  - 80 river miles
- CDWR vegetation/land cover GIS data by Robert McGill
- Co-occurrence of riparian vegetation on <60 year old floodplain in 1952 and in 1987
  - 35 year difference
- Model Variables
  - Patch size >5 ha (12 ac)
  - Patch width >100 m
  - Vegetation species composition (FPA <60 yrs)



Sub-patch Concept






RM 228
RM 219
RM 220
RM 209
River Mile
1952 Channel
1987 Channel
1952 Habitat Patch
1987 Habitat Patch
1952 and 1987 Habitat Patch
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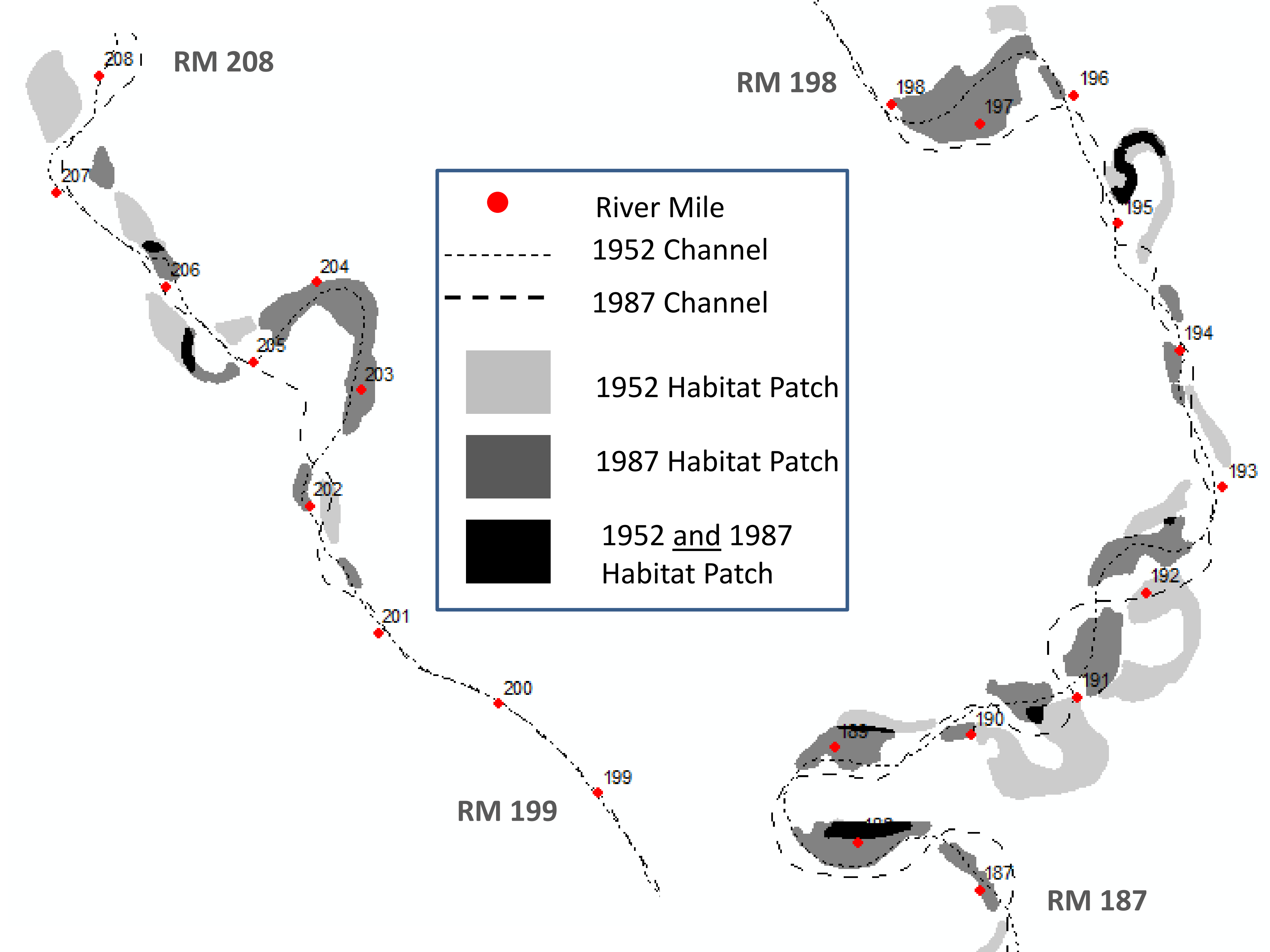
RM 208
RM 198
RM 199
RM 187
River Mile
1952 Channel
1987 Channel
1952 Habitat Patch
1987 Habitat Patch
1952 and 1987
Habitat Patch
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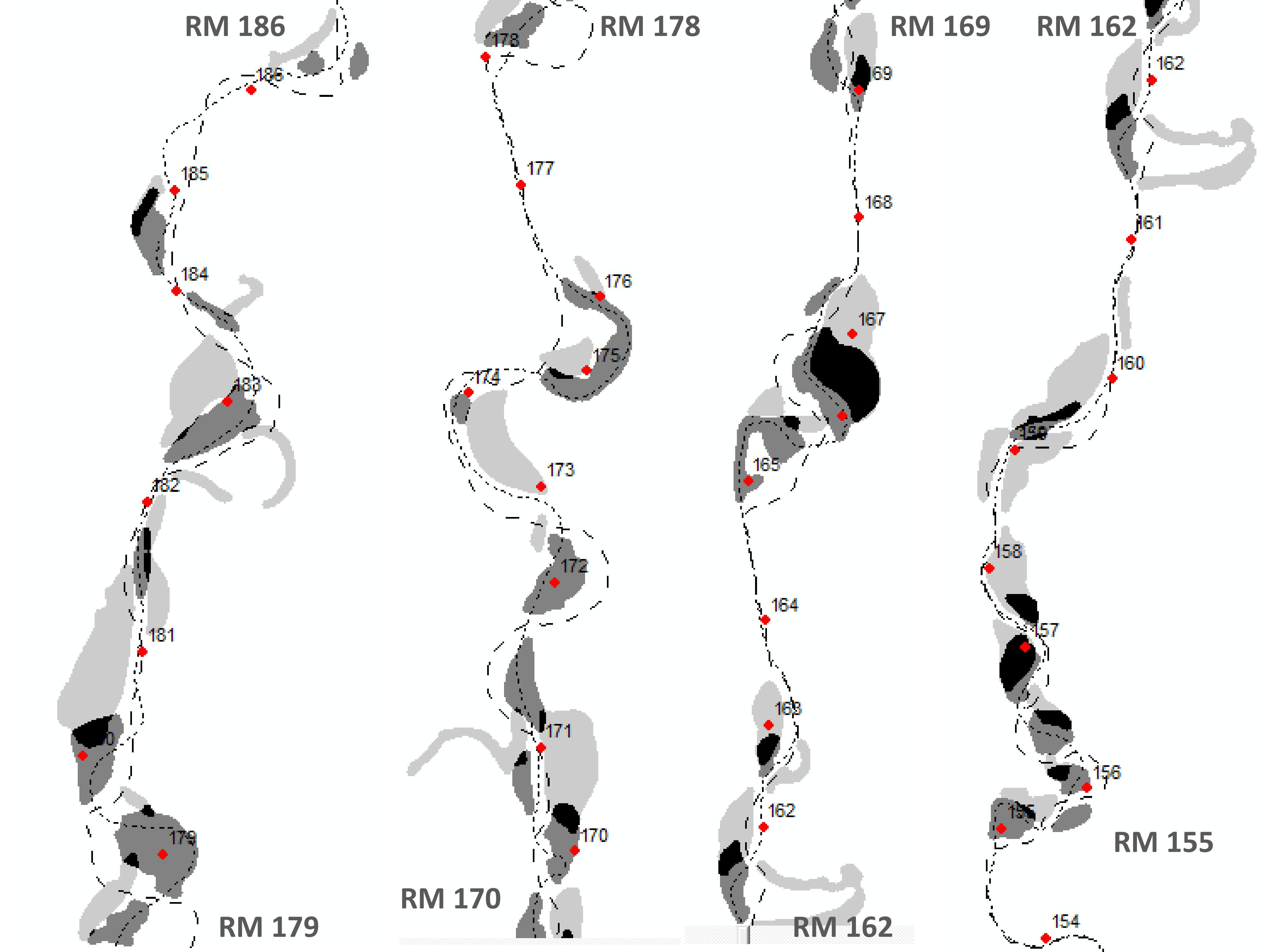

RM 186
RM 178
RM 169
RM 162
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RM 179
RM 170
RM 162
RM 155

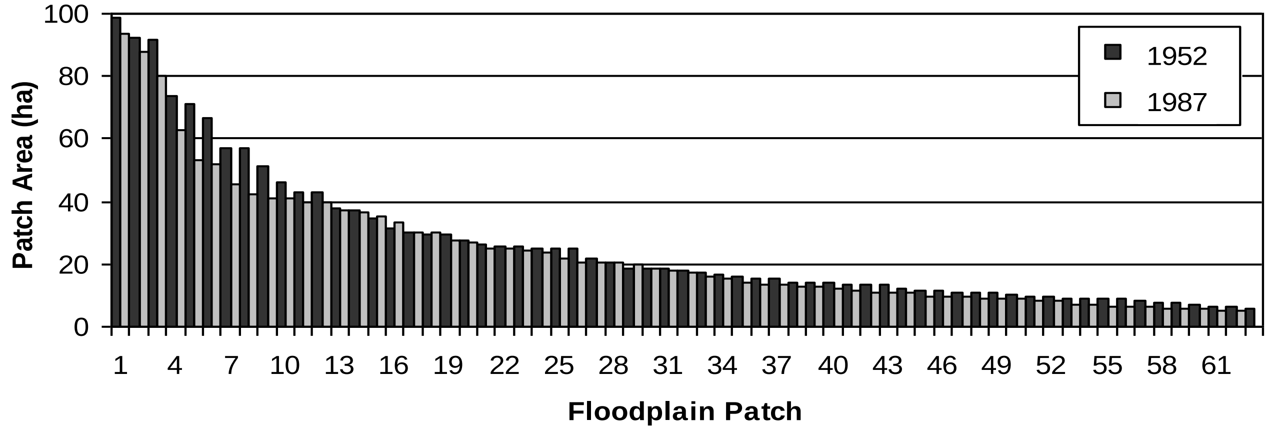
Shifting Mosaic Patch Analysis Findings

- Vegetation on floodplain <60 years old: 1952=1,664 ha   1987=1,479 ha (-11%)
- Only 247 ha were co-incident between 1952 and 1987 (15%)
- Of the 63 patches in 1952, 15 (24%) blinked out completely and 48 (76%) shifted adjacent to a patch in 1987
- Of the 62 patches in 1987, 17 (27%) arose anew independently of the patches in 1952 and the remaining 73% formed adjacent to the patches from 1952

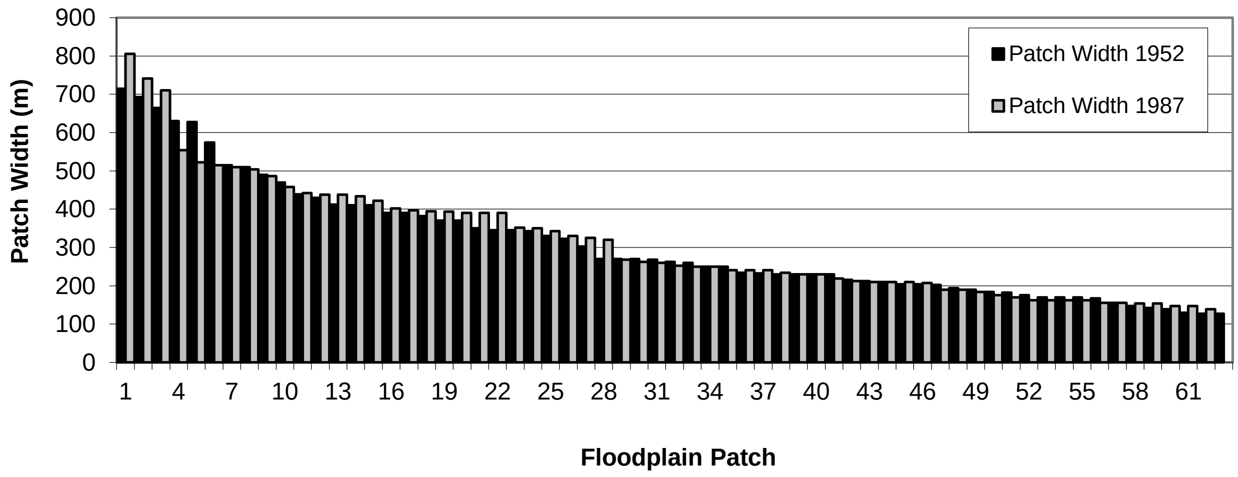
Sub-Patch Change Analysis

Frequency Distributions

AREA



WIDTH



Sub-Patch Change Findings

- Sub-Patch Area 1952
  - Number: 63
  - Range: 6-99 ha
  - Mean: 26 ha
  - Std Dev: 22.5 ha
- Sub-Patch Area 1987
  - Number: 62
  - Range: 5-93 ha
  - Mean: 24 ha
  - Std Dev: 19.9 ha
- Sub-Patch Width 1952
  - Number: 63
  - Range: 127-714 m
  - Mean: 310 m
  - Std Dev: 152 m
- Sub-Patch Width 1987
  - Number: 62
  - Range: 139-806 m
  - Mean: 316 m
  - Std Dev: 155 m

Sub-Patch Change Findings

- Remarkable stability over the 35 year time period
  - Despite:
    - 85% of patches changing location
    - 65% reduction in peak flows
    - 52% reduction in new land production
- Possible explanation:
  - The percent of land <65 years old colonized by riparian vegetation:
    - 1952: 21%
    - 1987: 37%
  - Reduction of scour allows more extant vegetation

Comparison of
Field Surveyed Patches for Yellow-billed Cuckoo Occupancy (1987-1990)*
and Patches Predicted for Yellow-billed Cuckoo (YBCU) Occupancy
Using Floodplain Age (1987)

n=56	Floodplain <60 years	Floodplain >60 years
YBCU Detected	33	8
YBCU Not Detected	4	11

Overall Accuracy = 79%
Commission Error = 7%
Omission Error = 14%

*Halterman 1991

Habitat Conservation Strategy

Reduce Physical Constraints:

Dams & Diversions: "naturalize" the hydrograph

Levees: set back in the floodplains away from main channel

Channel restraint (riprap): remove where feasible

Process-based Restoration ⟷ **Active Restoration**

Natural Processes:

- **Re-establish flooding regimes**
- ***Allow channel meander and cut-off***
- **Natural seed and vegetative dispersal**
- **Natural recruitment / regeneration *(emphasize primary succession)***
- **Rely on groundwater resources**
- **Not "passive" management**

Cultural Practices:

- **Horticulture / Planting: *zonation design (use reference sites)***
- **Accelerate succession *(emphasize secondary succession)***
- **Irrigate**
- **Grading: *restore former floodplain topographic variation and reconstruct former overflow channels in terraces***

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- ***Alex Young***
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Photo by James Gallagher, Sea and Sage Audubon