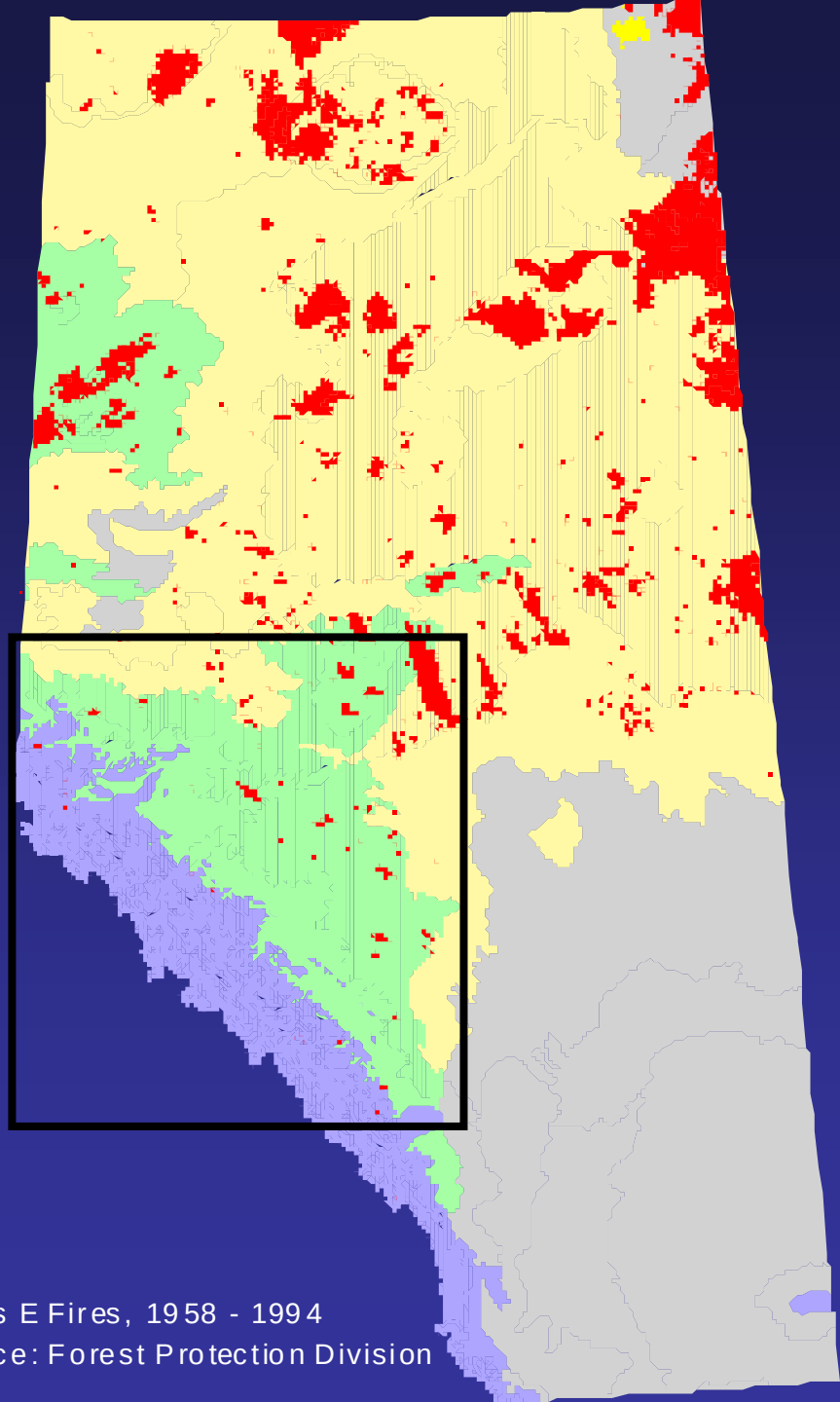
Fine-Scale Disturbance Patterns on FMF Landscapes

- Island remnant patterns
- Where fires tend to burn and not to burn
- Disturbance through riparian corridors
- Residual woody structures

Island Remnants Research

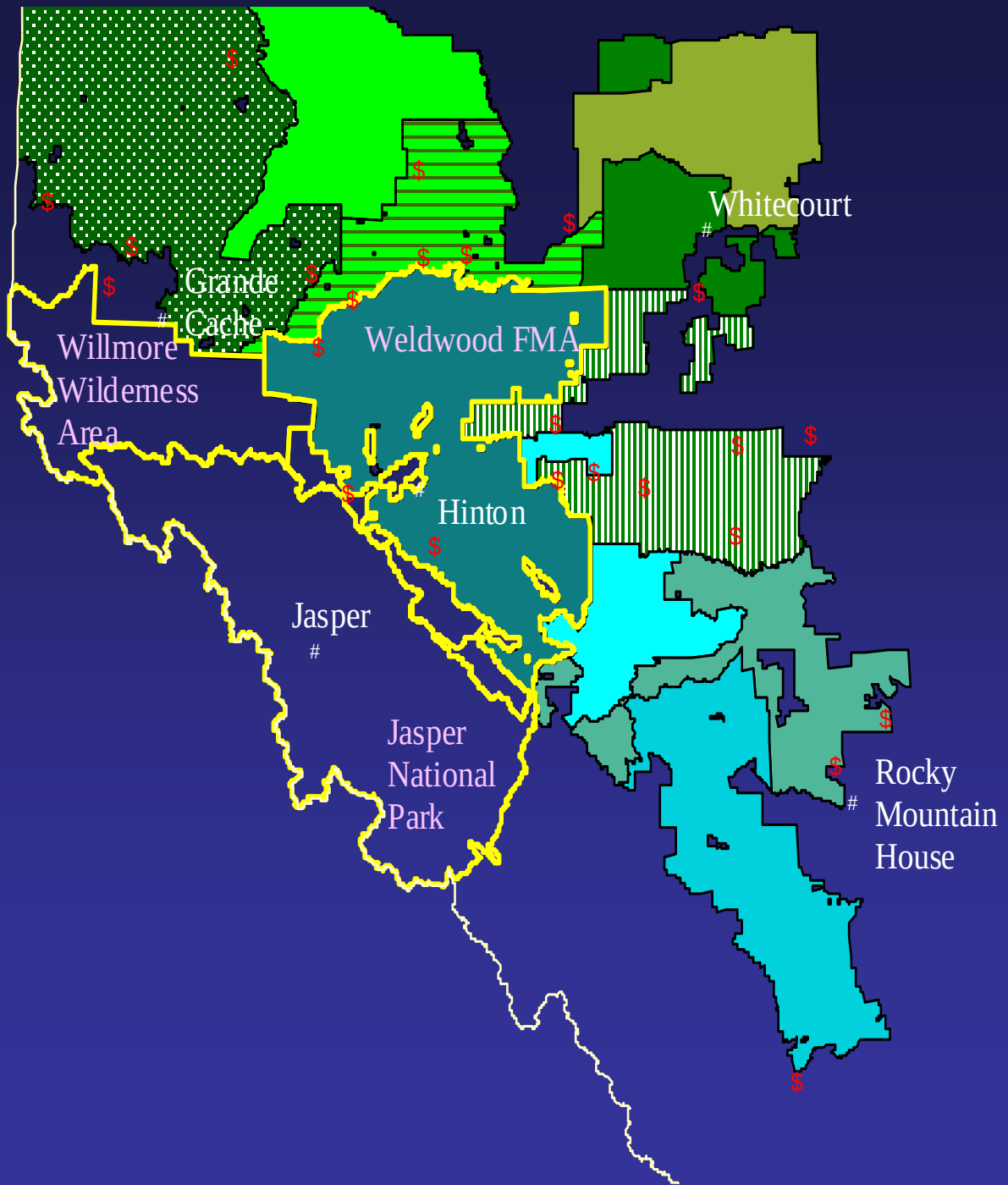
- 25 Historical Foothills Fires
- 28 to 16,000 ha
- Subalpine, UF, LF
- 0.1 ha resolution
- 5 classes of islands
- Digital data layers = post-burn AVI, DEM, pre-burn AVI, creeks.
- Some field sampling

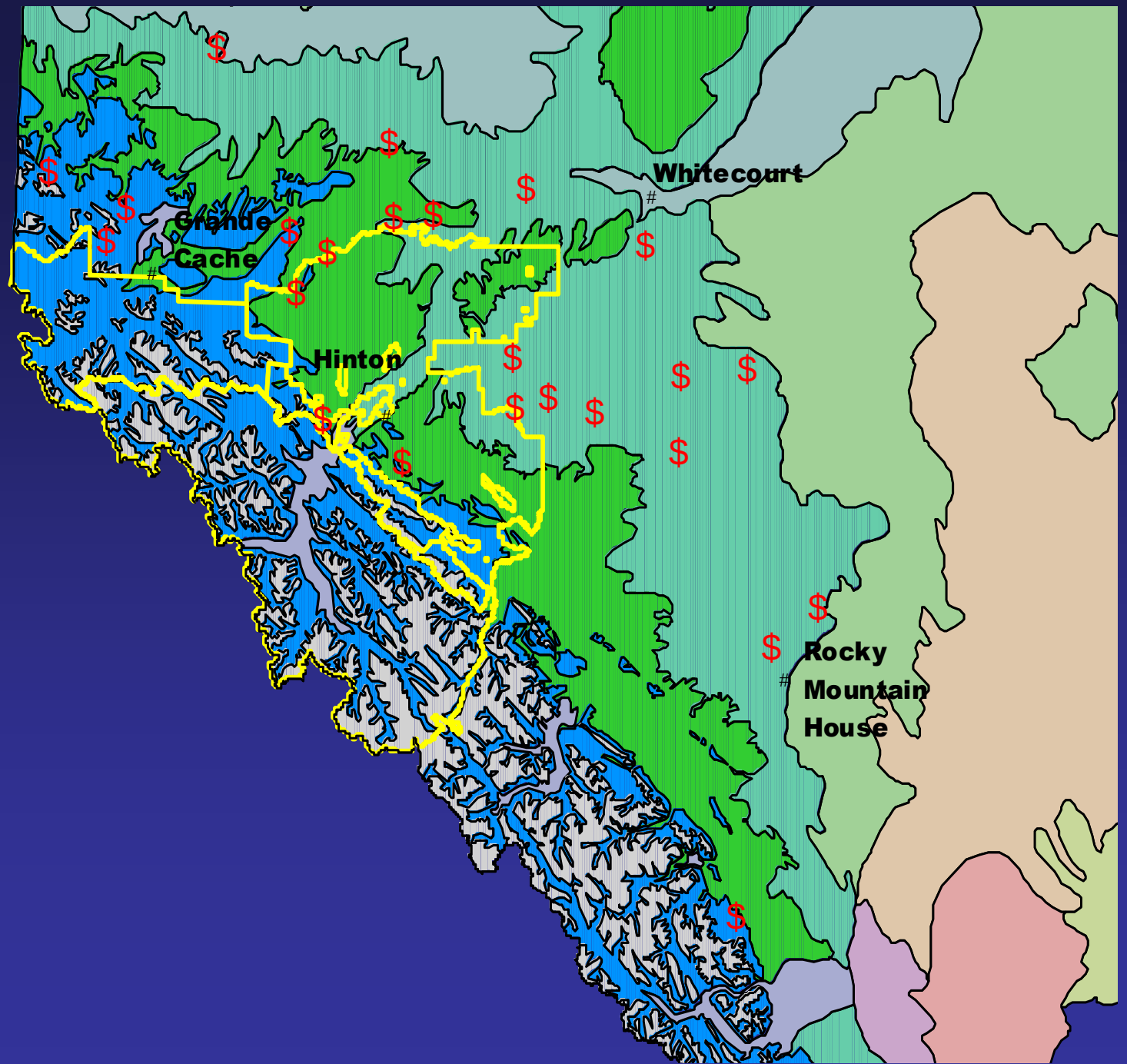


Class E Fires, 1958 - 1994
Source: Forest Protection Division

25 Sample Fires

Weldwood	**4**
Weyerhaeuser:	
Edson	**6**
G. P.	**3**
Drayton	**3**
ANC	**6**
Millar Western	**1**
Sundance	**1**
FMU E4	**1**




Whitecourt
Grande
Cache
Hinton
Rocky
Mountain
House

Island Remnants Example

Wolf Creek Burn

215 ha Burn (1961)

6 Disturbed Patches over 156 ha

81 Remnant Islands covering 58 ha

6 ha undisturbed

47 ha moderately disturbed

5 ha heavily disturbed

Island Remnants Example

Greg River Burn

8,886 ha Burn (1956)

13 Disturbed Patches over 8,415 ha

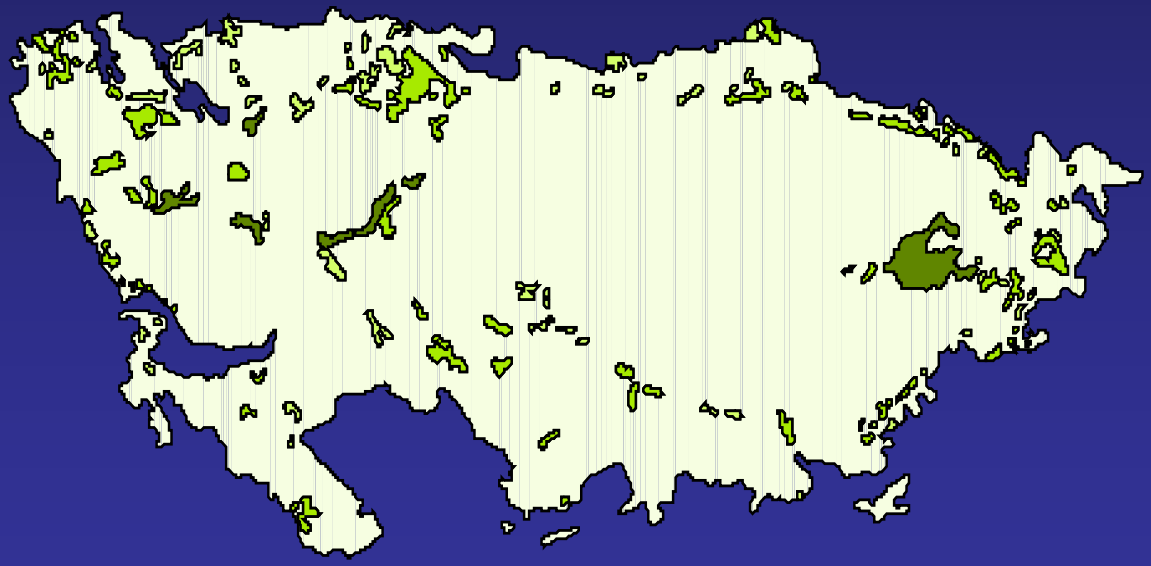
326 Remnant Islands covering 471 ha

168 ha undisturbed

276 ha moderately disturbed

27 ha heavily disturbed

Island Remnants Example



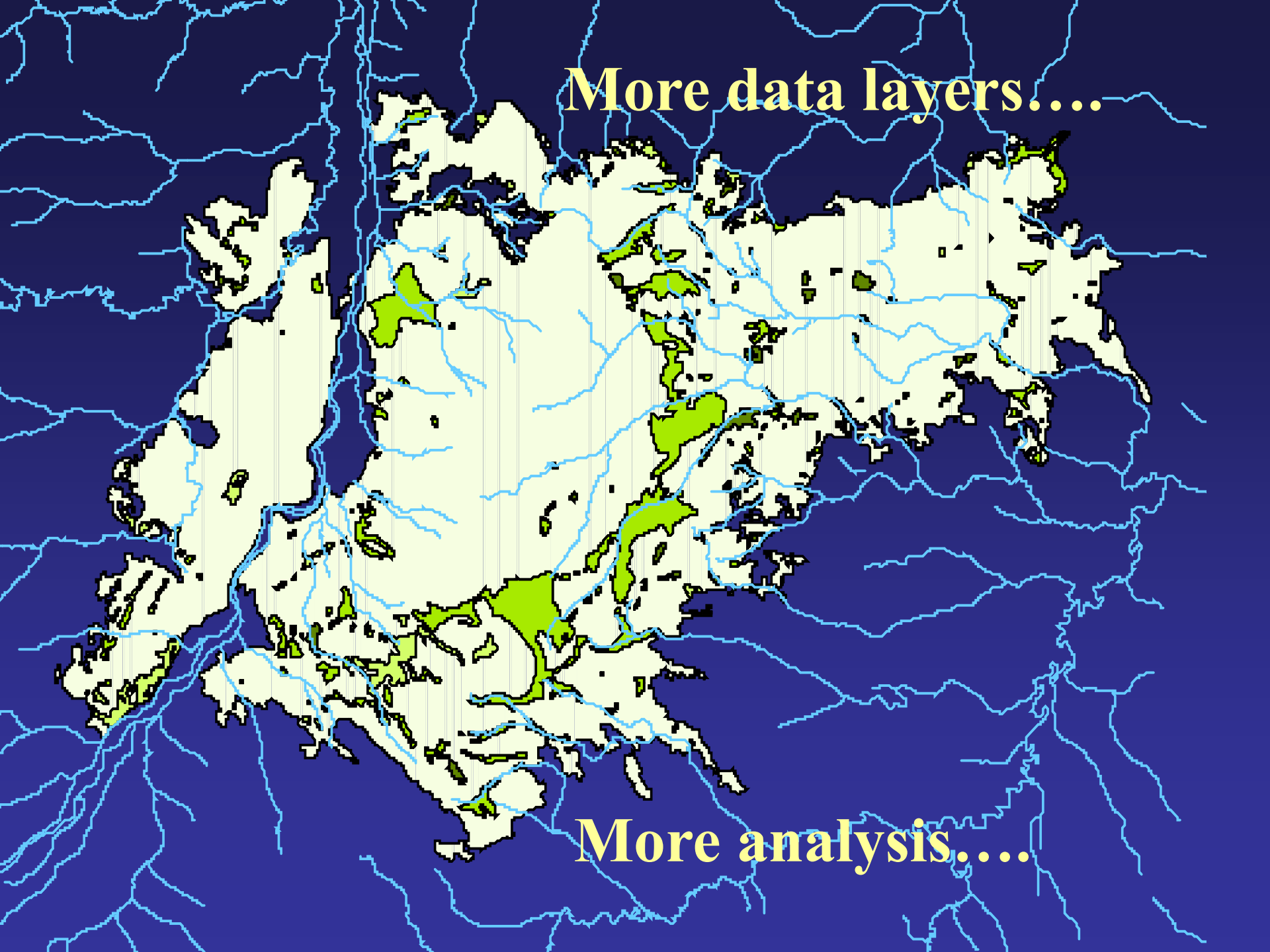
Athabasca Burn

364 ha Burn (1974)

4 Disturbed Patches over 340 ha

133 Remnant Islands covering 25 ha

- ***5 ha undisturbed***
- ***13 ha moderately disturbed***
- ***7 ha heavily disturbed***


More data layers….
More analysis….

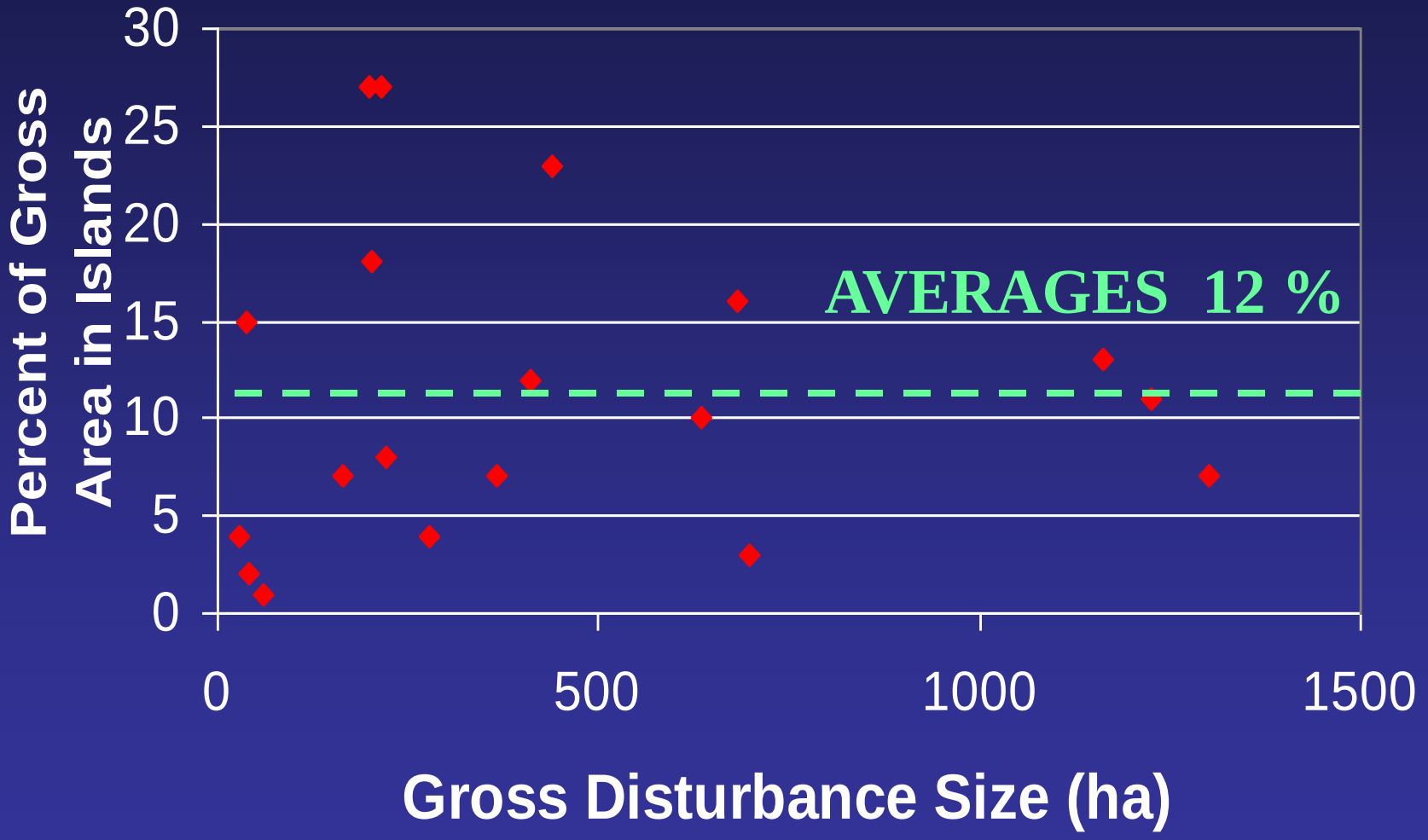
ISLAND = Any contiguous area of same-aged forest that survived the last stand-replacing disturbance.

FOREST PATCH = The contiguous, gross area of same-aged (within 20 years) forest. (includes islands & non-forested areas).

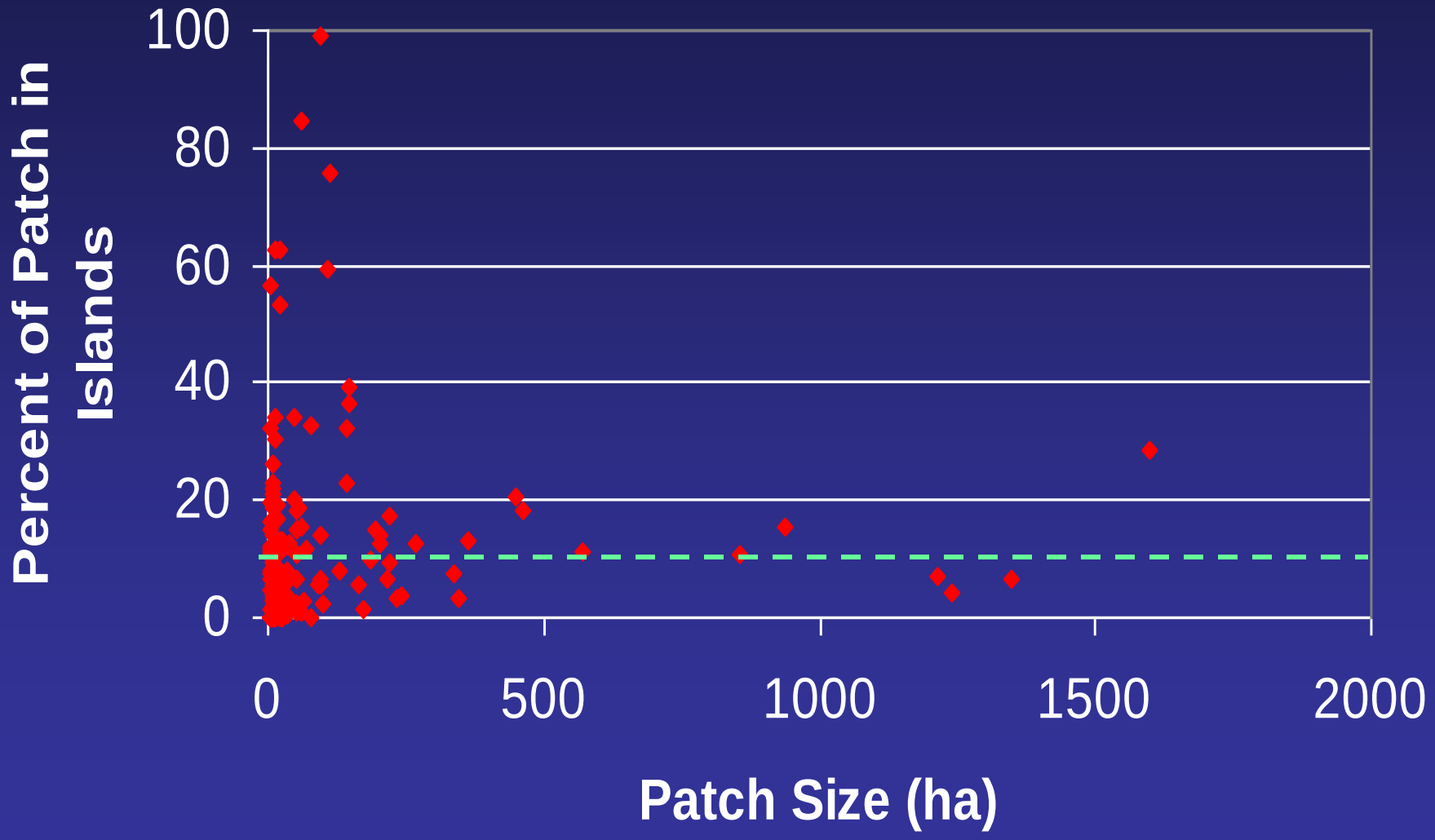
DISTURBANCE = A collection of young forest patches created from the same event.

EVENT = The greater area of a disturbance (formed by a collection of forest and non-forest patches)

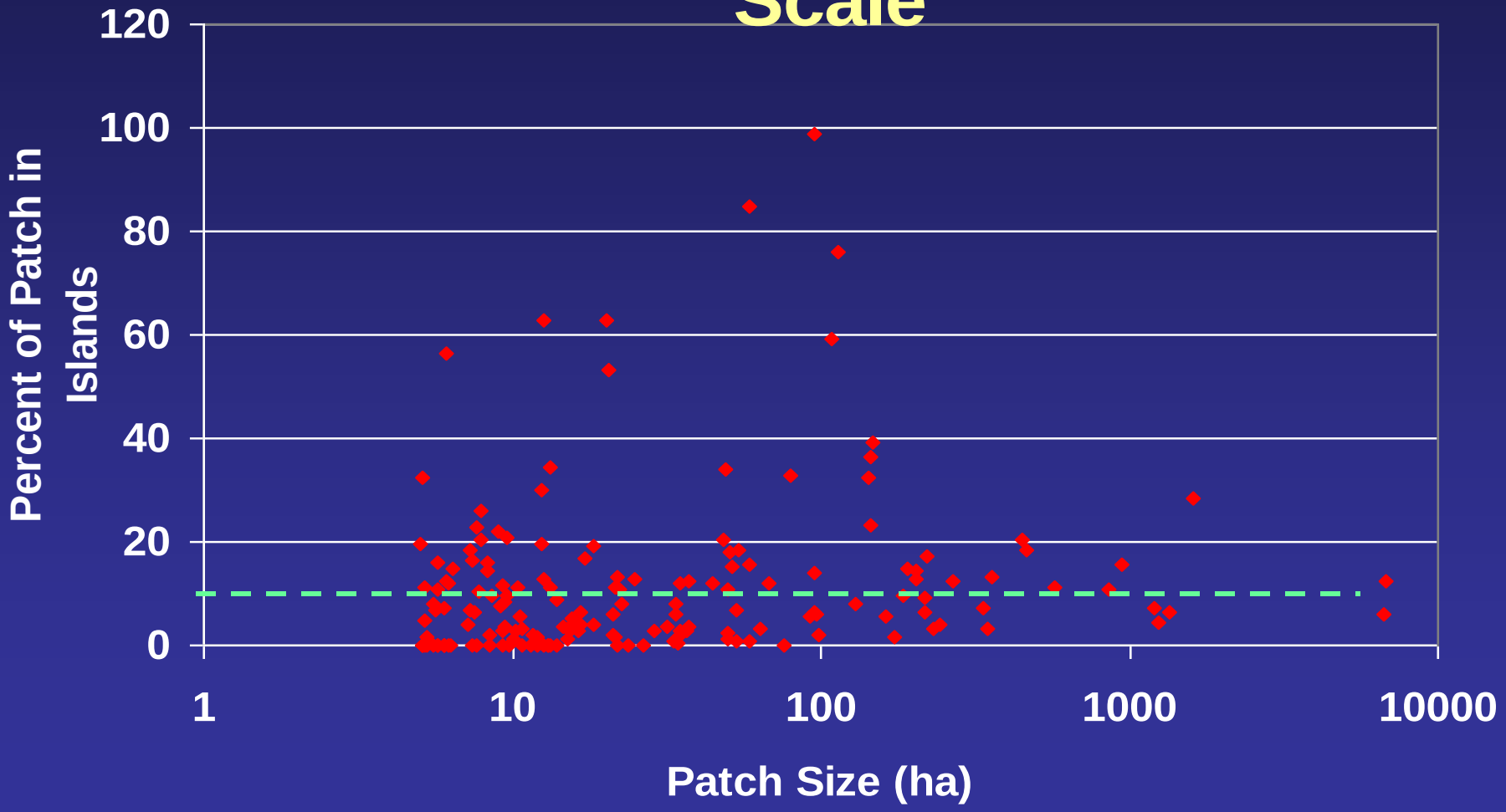
Total Area in Island Remnants by Disturbance



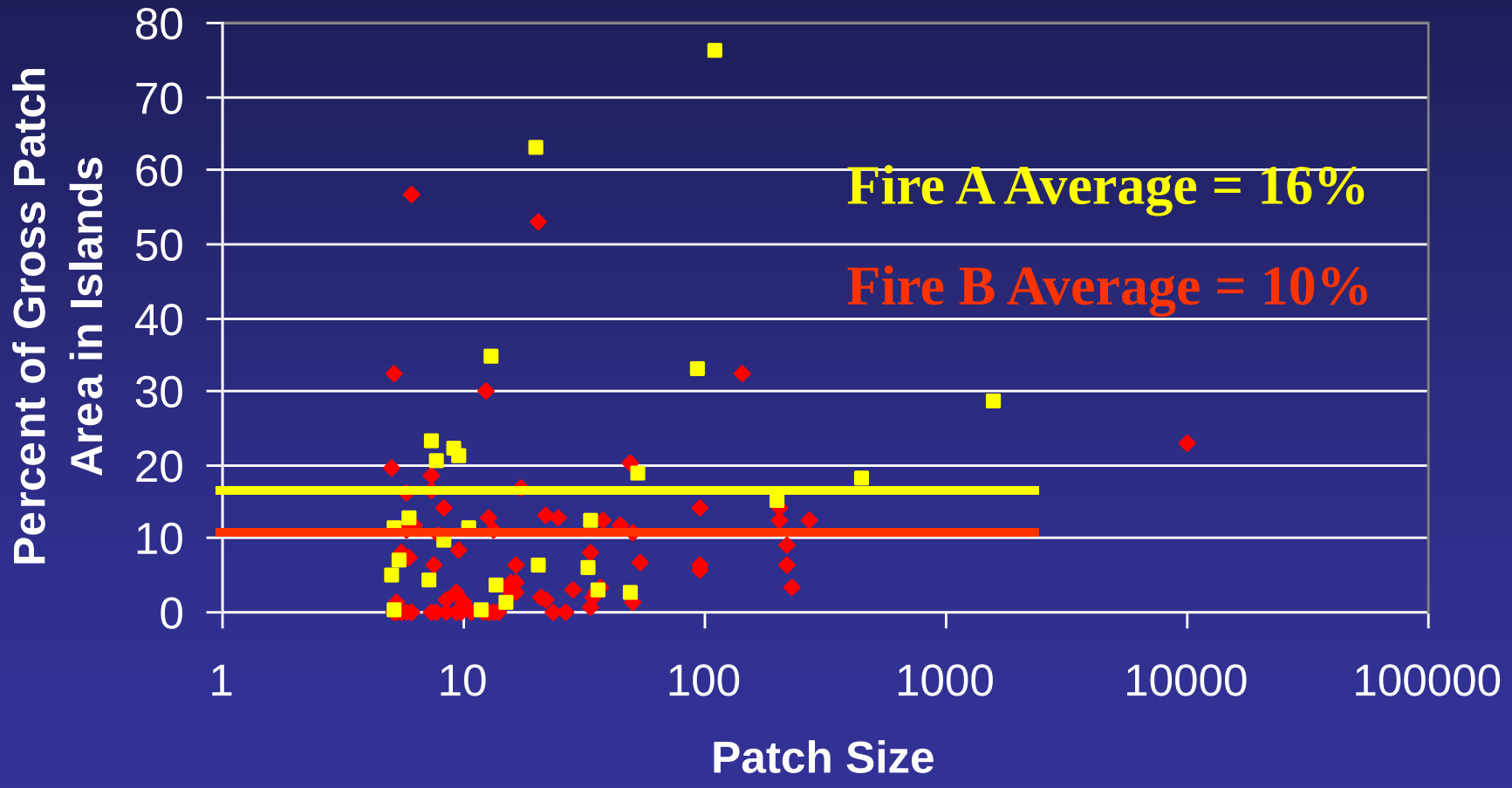
Total Area in Island Remnants in all Patches in all Disturbances



Total Area in Islands in All Patches in All Disturbances - Log Scale



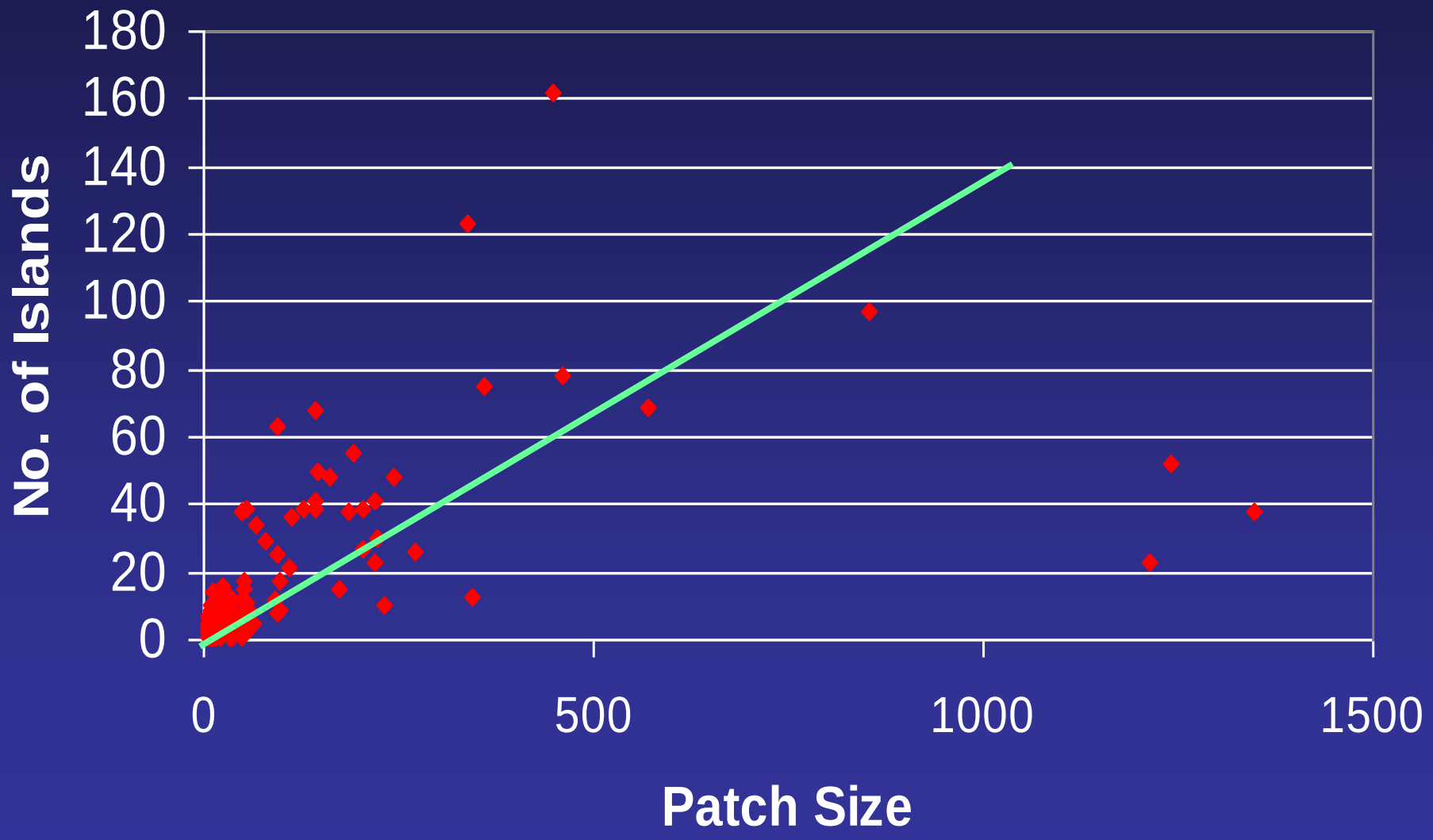
Island Remnant Area by Patch for 2 Disturbances



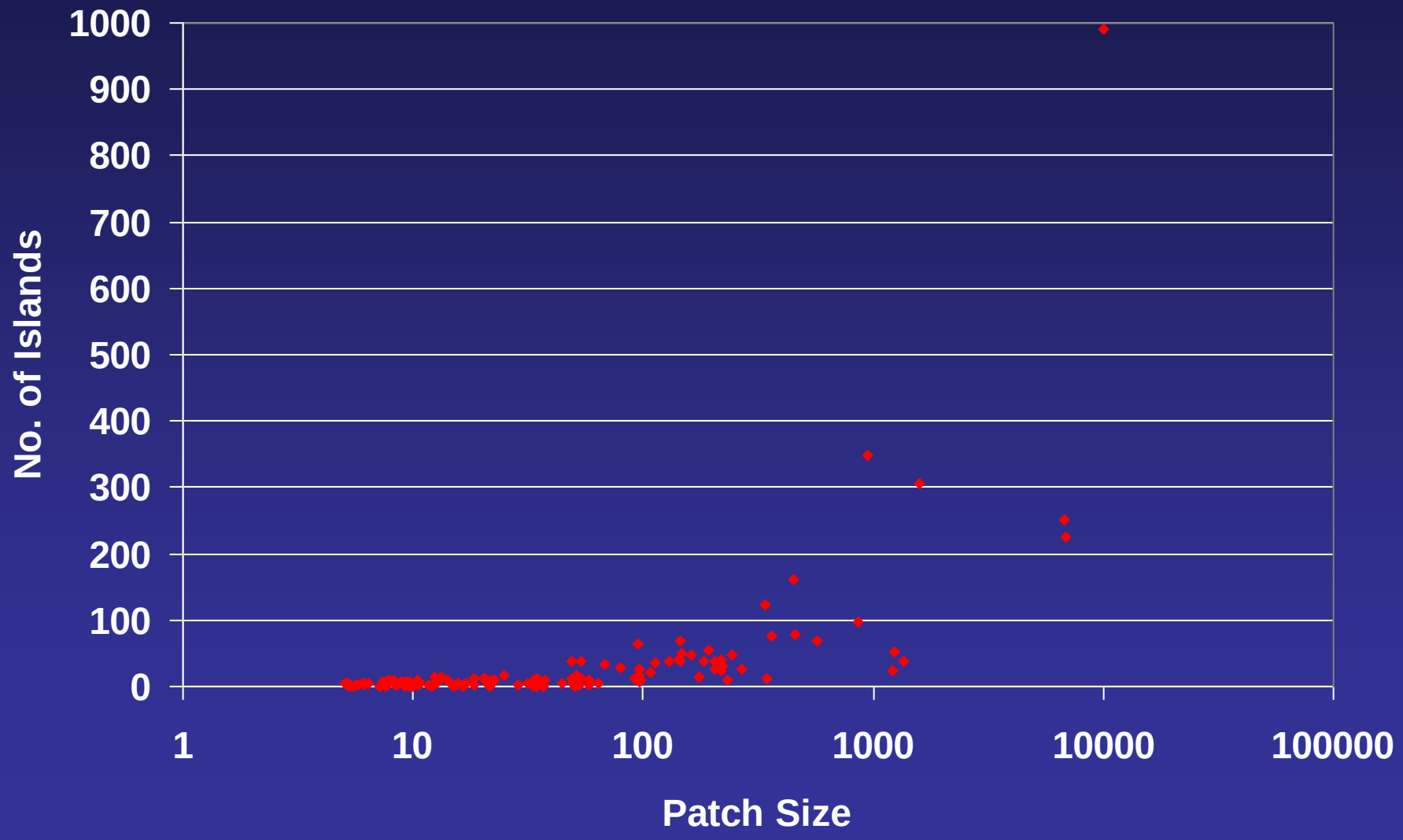
How Much Area are in Island Remnants?

- **The area in island remnants averages 4-20% of the gross area of the disturbance or patch (based on 1 standard deviation).**
- **No evidence (so far) to suggest that island remnant area is related to ecological sub-region.**
- **No evidence (so far) to suggest that island remnant area is related to disturbance or patch size.**
- **Areas in island remnants are somewhat more consistent *within* disturbance events than *between* disturbance events.**

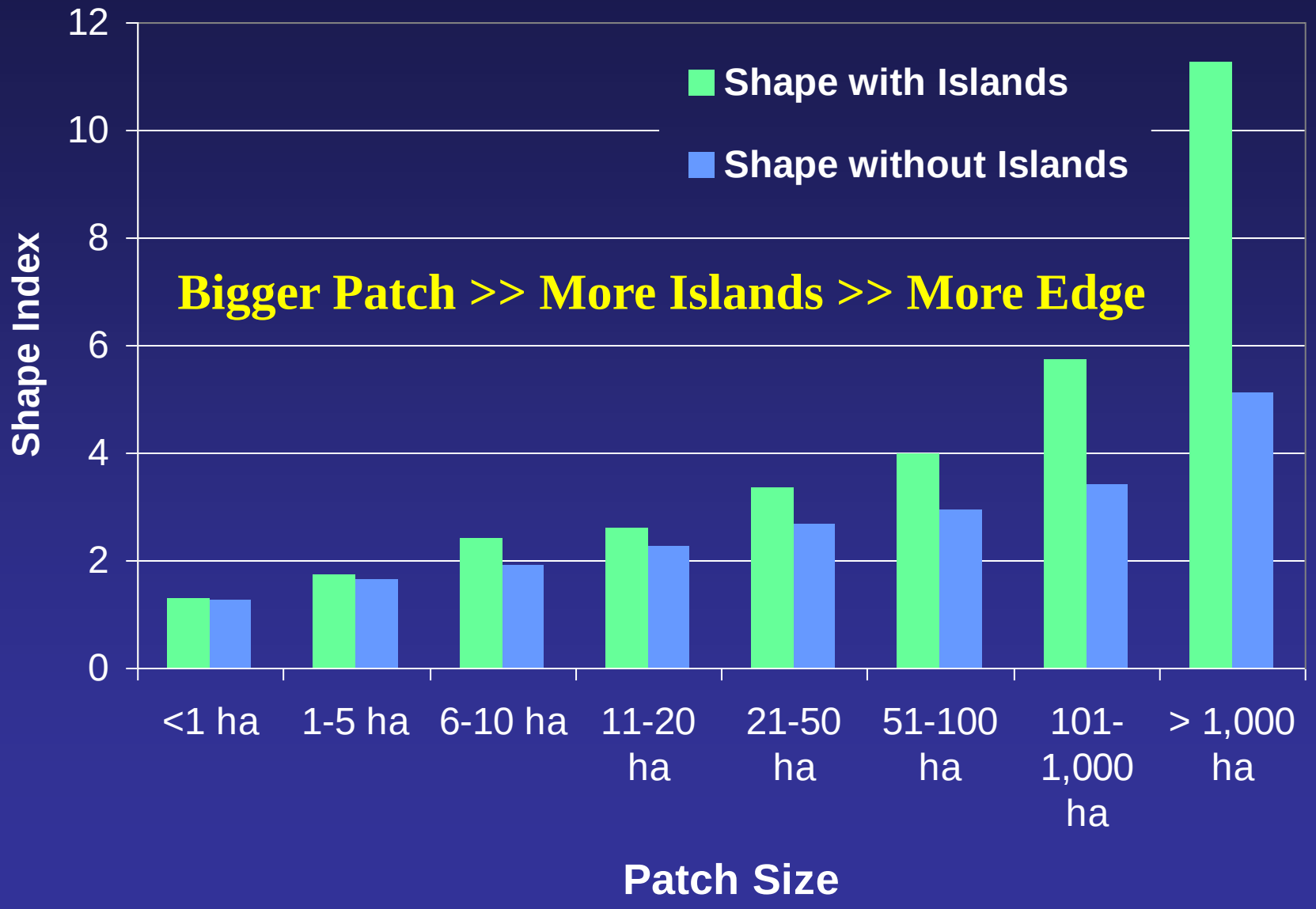
Island Remnants per Patch



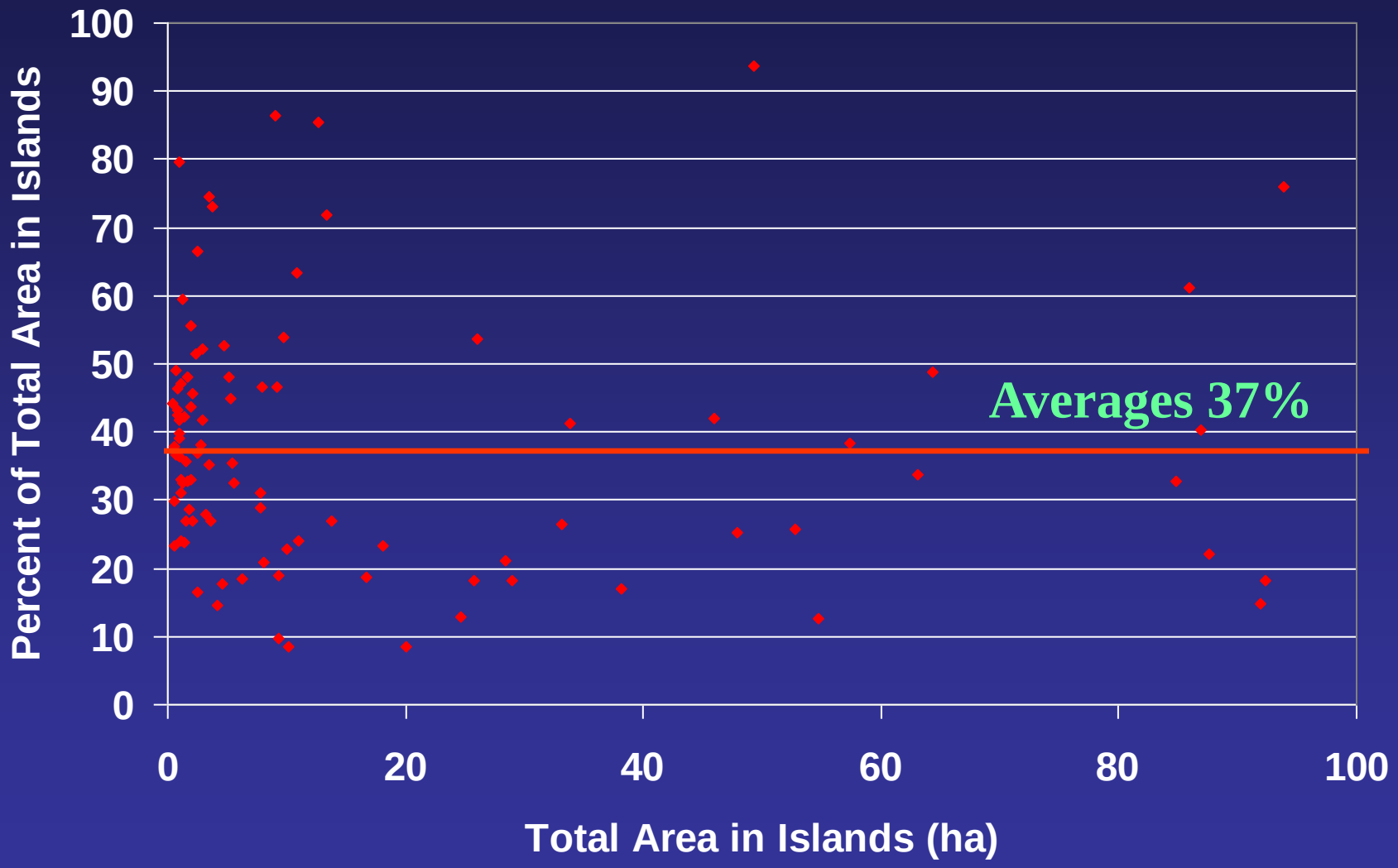
Island Remnant per Patch - Log Scale



Influence of Islands on Patch Shape



How Big is the Largest Island?



Areas in Island Remnants

5,117 Islands in the entire sample dataset

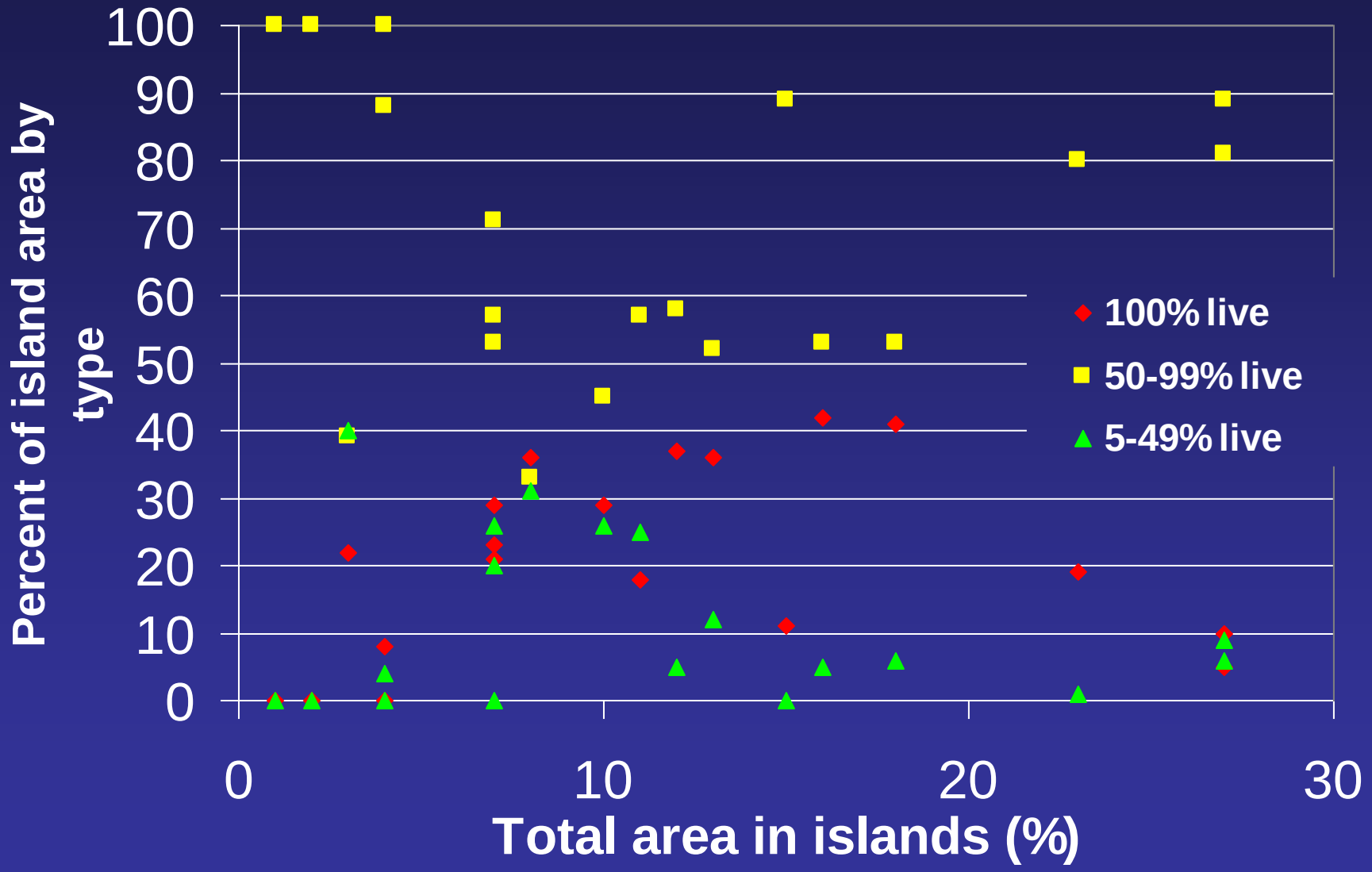
… most are very small.

4,225 islands	**<1 ha**
466 islands	**1-2 ha**
350 islands	**2-10 ha**
67 islands	**10-100 ha**
4 islands	**> 100 ha**

How are Numbers and Sizes of Island Remnants Distributed?

- Numbers of island remnants increase with patch size.
- Very small islands (<1 ha) account for over 80% of the total number of islands.
- The largest island accounts for 18-56% of the total area in island remnants (based on 1 standard deviation).
- The increase in the number of islands with increasing patch size create more edge (i.e., shape complexity).

Island Remnant Types



Do all Islands Survive Equally?

- **Islands have a range of disturbance survival. Within 1 standard deviation, or 68% of the observed values:**

  -8-38% of island areas are undisturbed.

  -45-87% of island areas are moderately disturbed (50-99% survival).

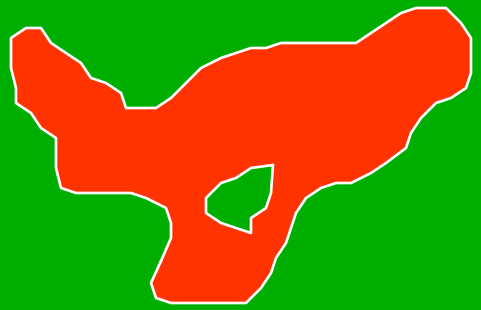
  -0-23% of island areas are highly disturbed (5-49% survival).

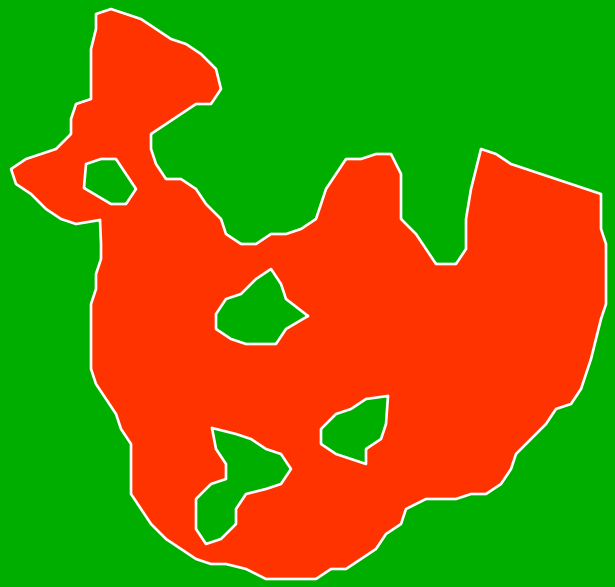
- **Disturbance survival of islands is unrelated to the total area in islands *or disturbance or patch size.***

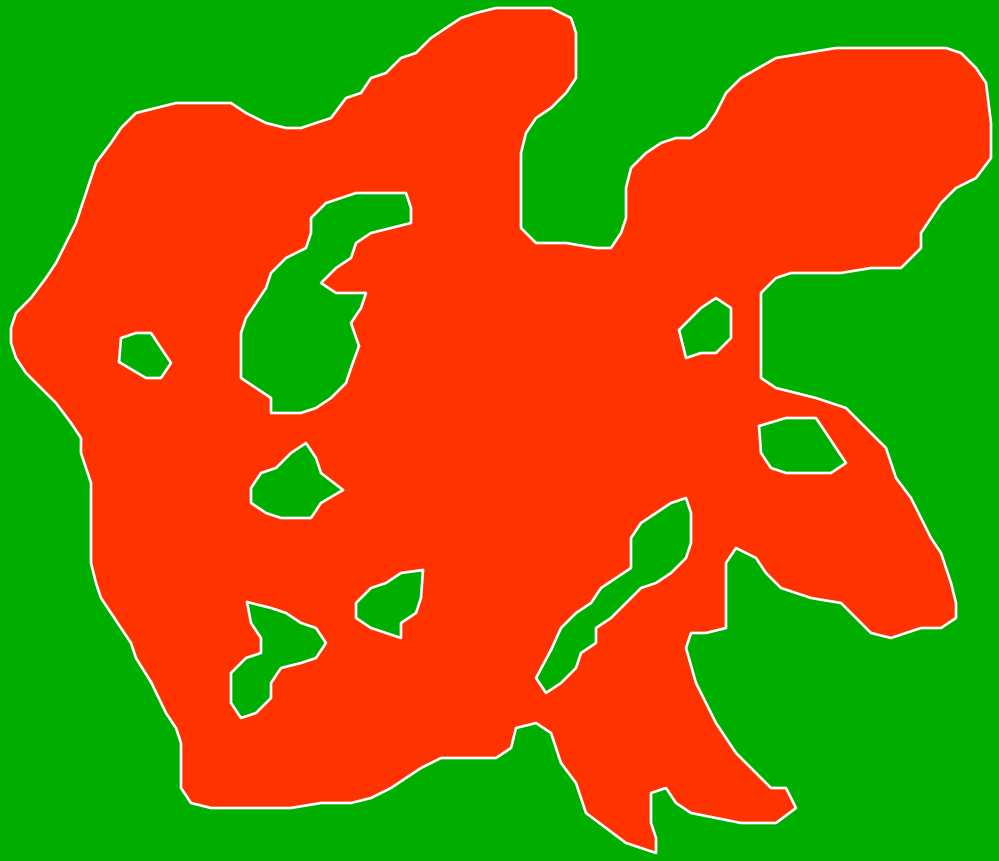
What are the Dominant Controls?

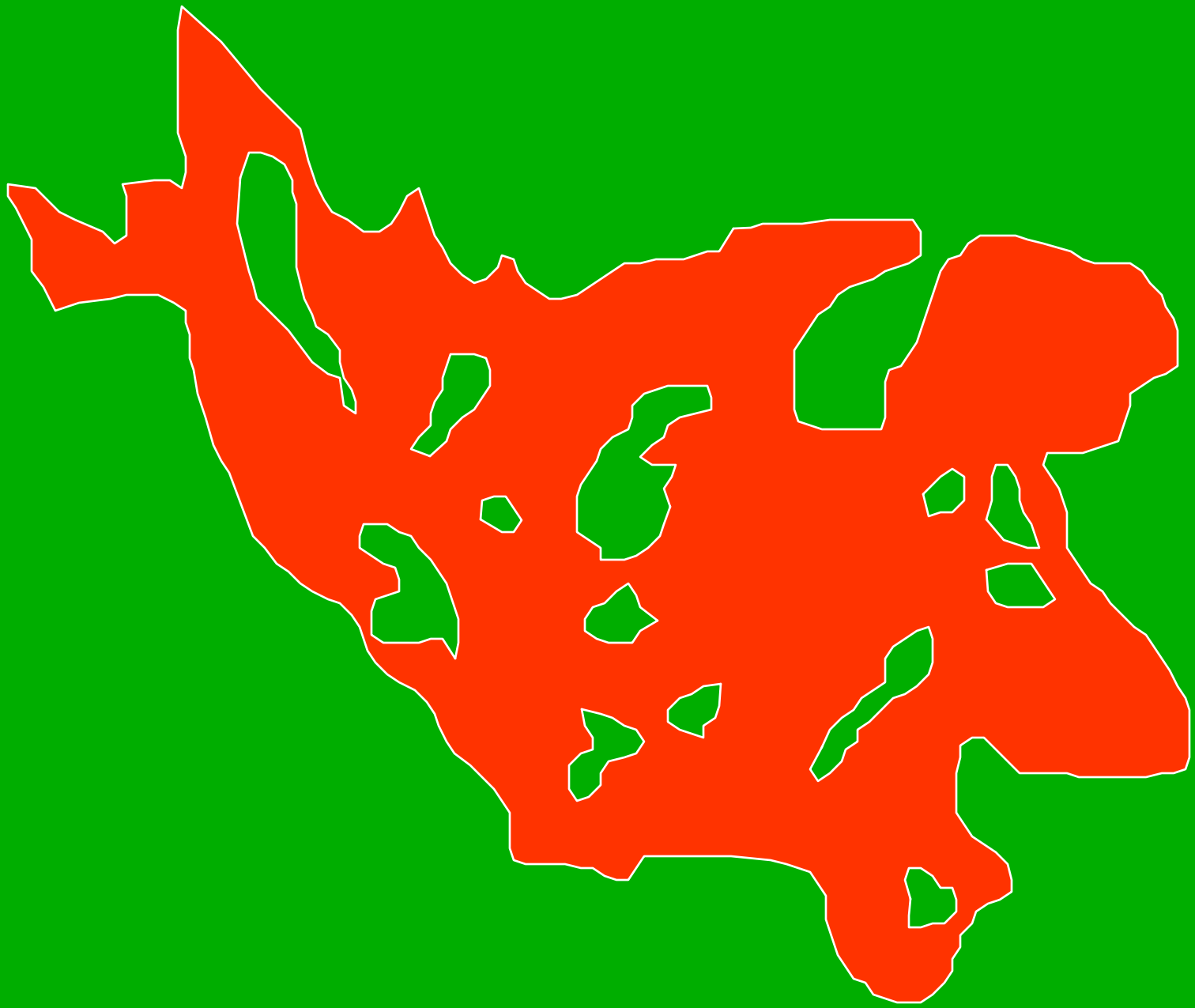
- Fuel-type?
- Topography?
- Fire weather?

… it depends.









Jasper National Park - Tendency to be Old

POSITION	N	NE	E	SE	S	SW	W	NW
Valley	+++	+					++++	+
Ridge								
Bench	+	+	+					
Toe		+						
Sl. Valley		+					+	
Sl. Ridge								
Gentle Sl.		+	+++	+++			++	+++
Gently R.		+	++				+++	

Jasper National Pk. - Tendency to be Old

POSITION	N	NE	E	SE	S	SW	W	NW
Valley					---	-		
Ridge				-	---	--		
Bench				-	--	--	-	
Toe					--	---	----	
Sl. Valley					-	-		
Sl. Ridge				-	---	--		
Gentle Sl.					---	--		
Gently R.								

Jasper National Park - Tendency to be Old

POSITION	N	NE	E	SE	S	SW	W	NW
Valley	+++	+			---	-	++++	+
Ridge				-	---	--		
Bench	+	+	+	-	--	--	-	
Toe		+			--	---	----	
Sl. Valley		+			-	-	+	
Sl. Ridge				-	---	--		
Gentle Sl.		+	+++	+++	---	--	++	++++
Gently R.		+	++				+++	

Upper Foothills - Tendency not to be Old

POSITION	N	NE	E	SE	S	SW	W	NW
Valley				-	--	--		
Ridge			-	--	-			
Bench						-		
Toe	--				---		--	-
Sl. Valley	-	-	-	-	--	--		
Sl. Ridge	-	--	--	---	--	-	-	
Gentle Sl.				-				
Gently R.				-	-			

Upper Foothills - Tendency to be Old

POSITION	N	NE	E	SE	S	SW	W	NW
Valley					+			
Ridge								
Bench								
Toe								
Sl. Valley								
Sl. Ridge								
Gentle Sl.								
Gently R.								

Small-Scale Control Issues

- **There is more topographic control of disturbance patterns in more topographically complex landscapes such as JNP.**

  = both spatial + aspatial edge and island location.

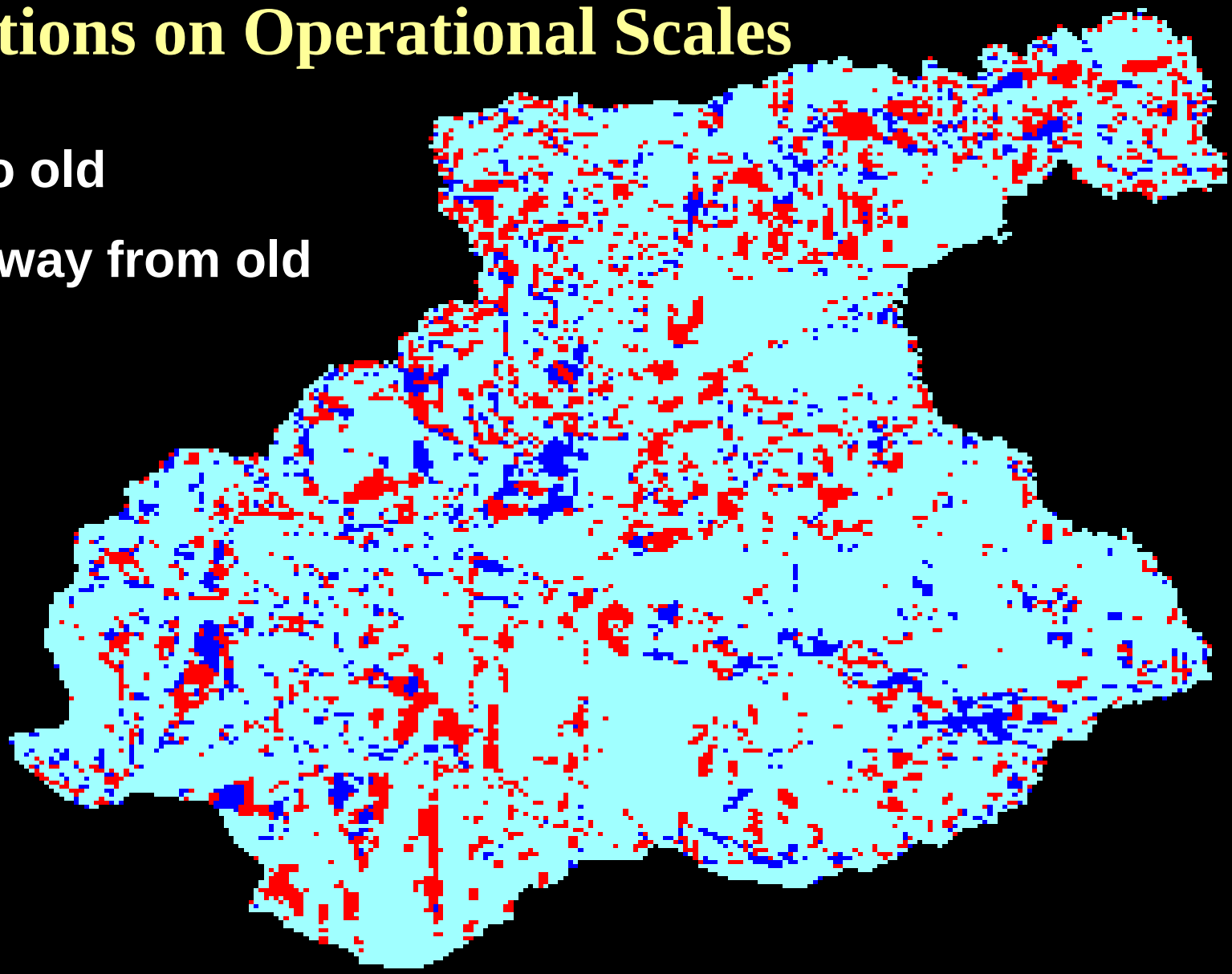
- **On topographically simple landscapes (Weldwood FMA), island and edge formation is less a function of slope position and aspect, and probably more a function of fire weather.**

  = stronger emphasis on aspatial application of island numbers and areas.

Demonstration of "Hot" and "Cold" Positions on Operational Scales

Tend to old

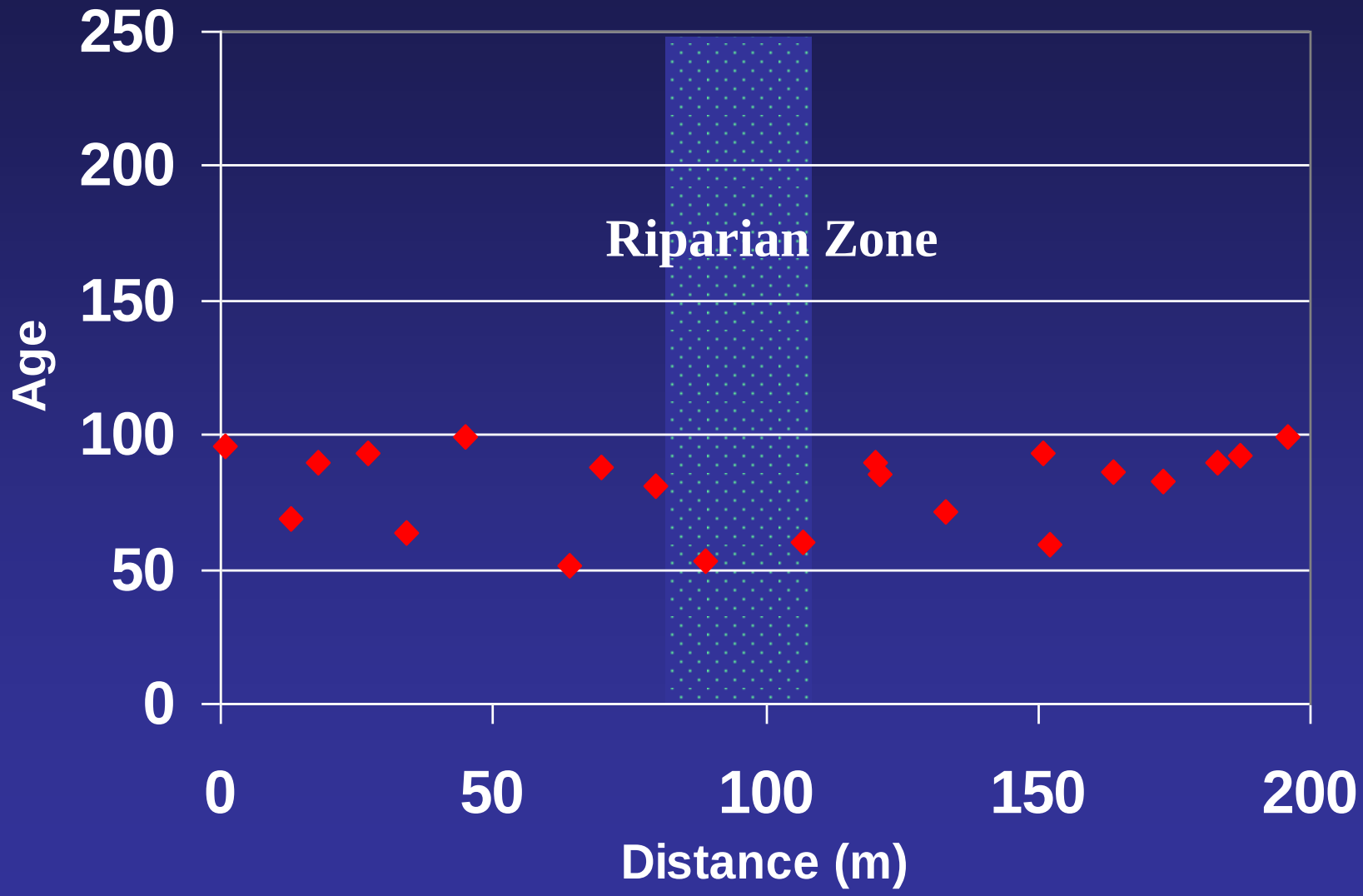
Tend away from old



Do Fires Burn Differently Through Riparian Zones?

- 15 Transects, continuous sampling
- Small to large streams, steep to gradual, wide to narrow banks
- Pilot study

Do Fires Burn Differently Through Riparian Zones?



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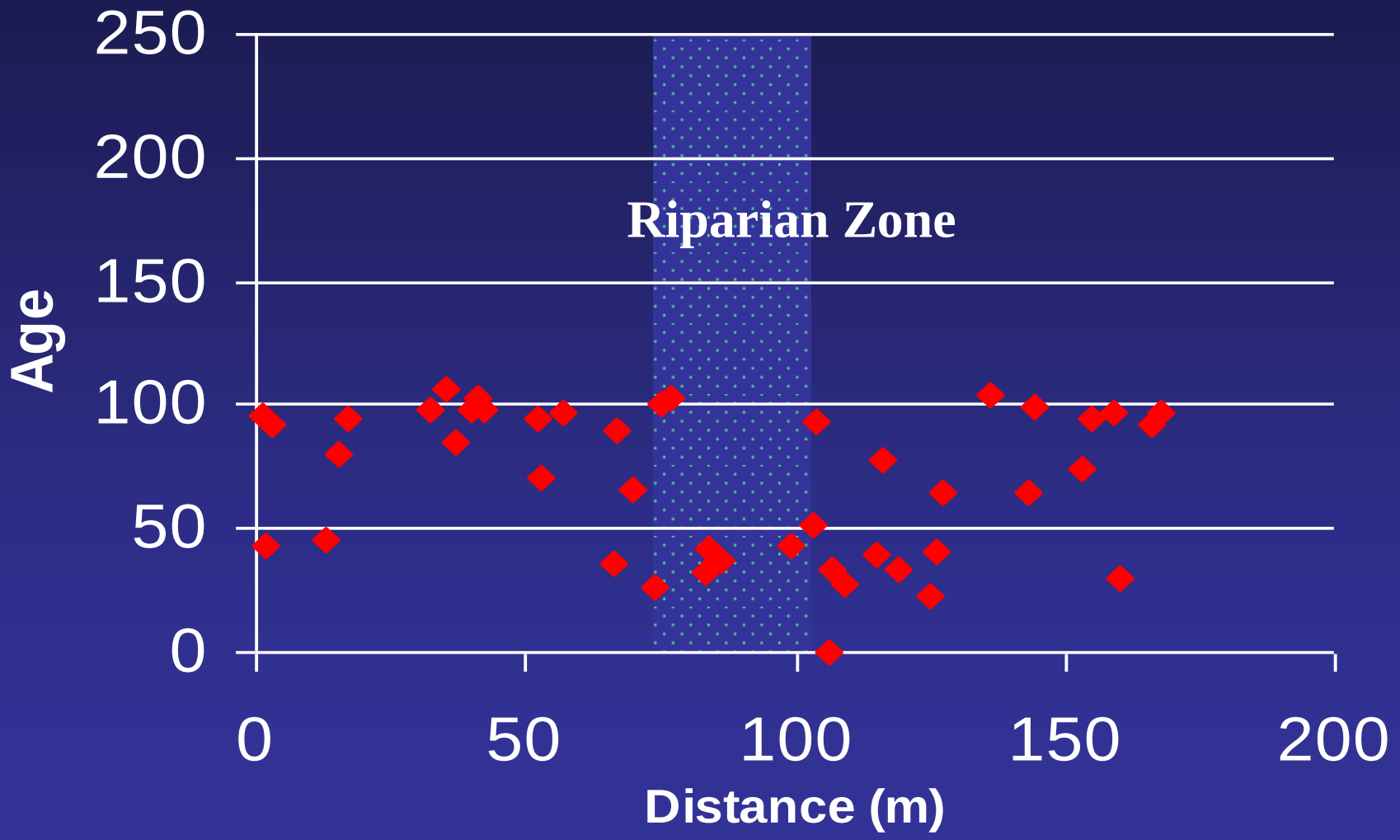

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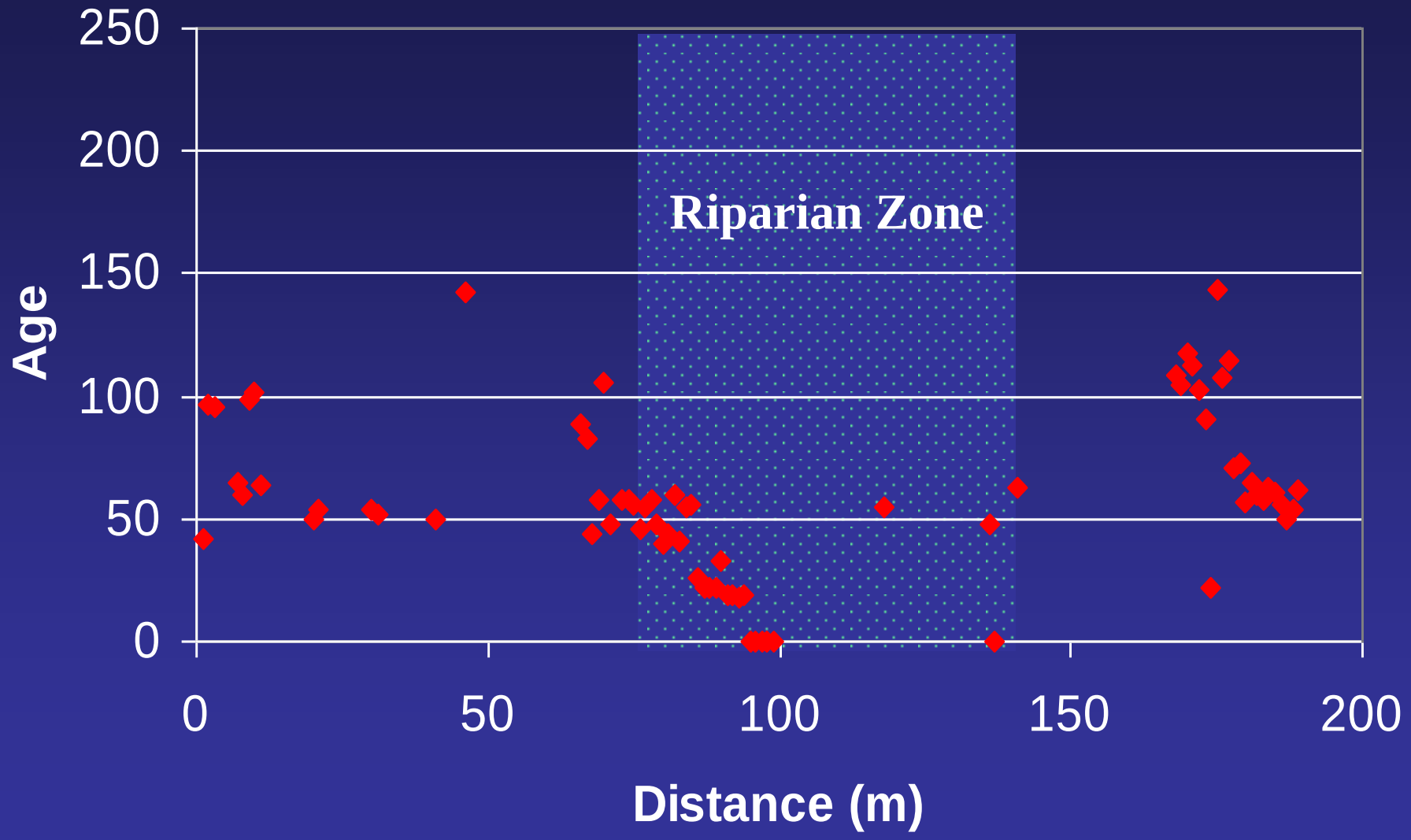

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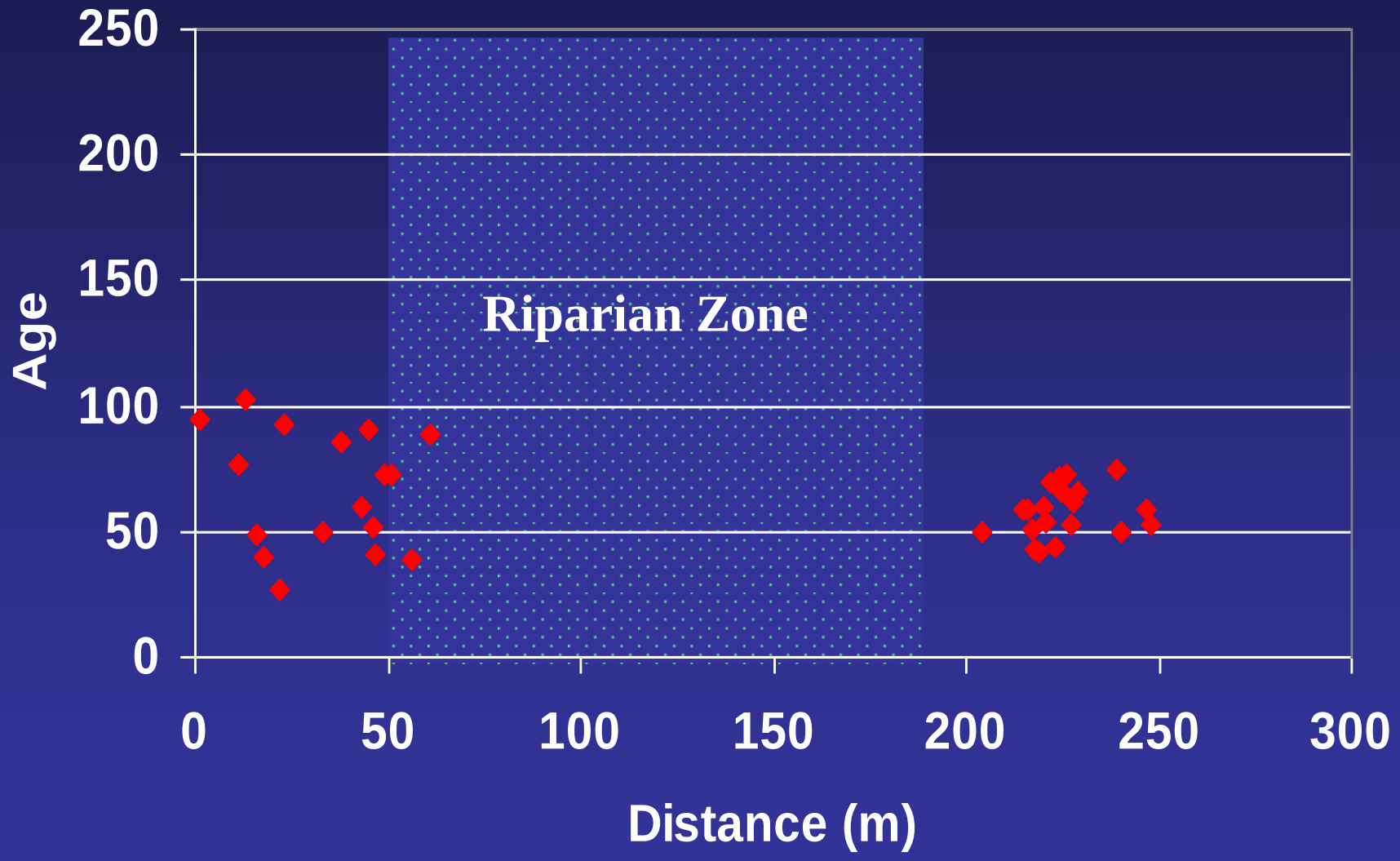
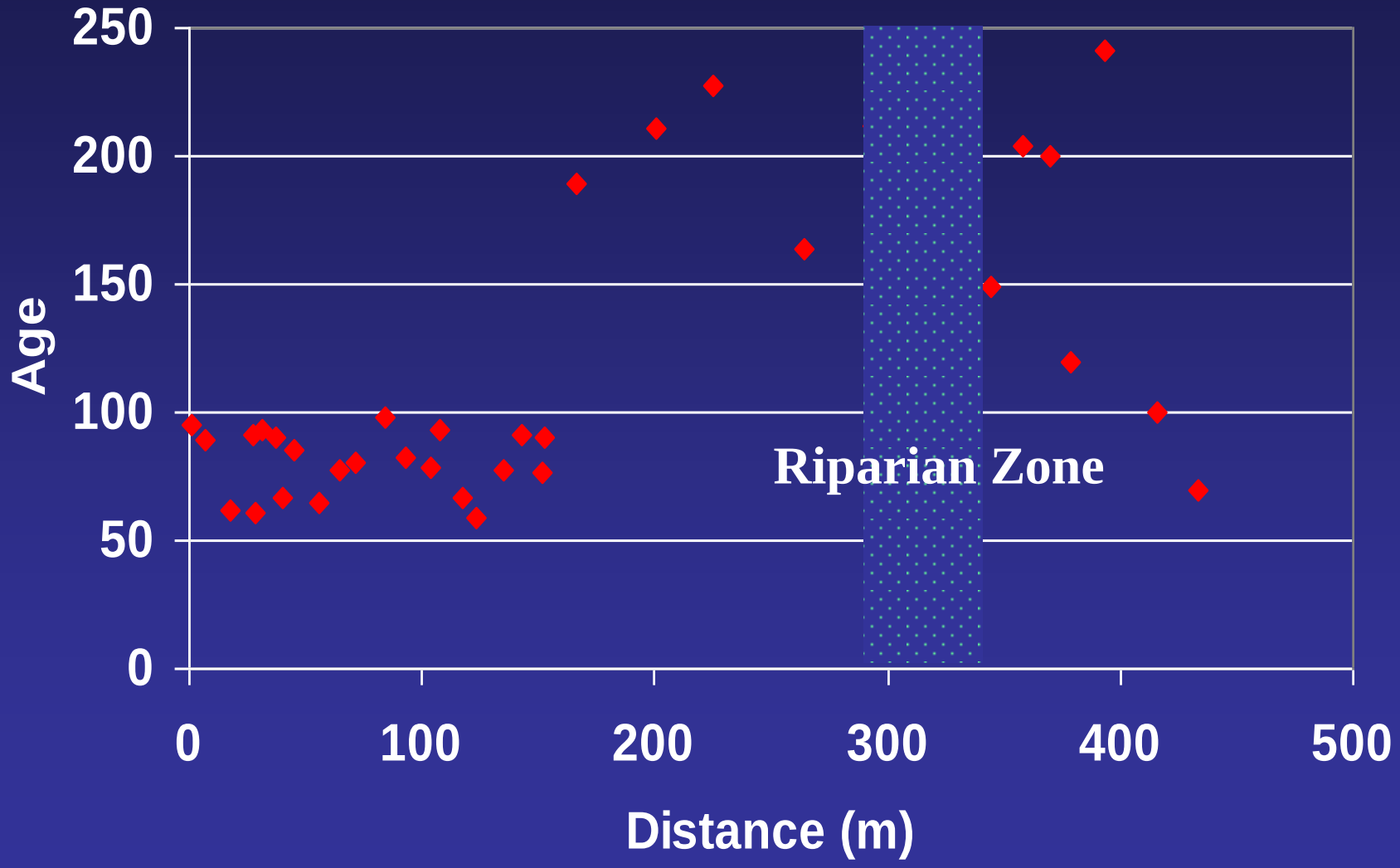


Do Fires Burn Differently Through Riparian Zones?



Do Fires Burn Differently Through Riparian Zones?

Sometimes……. but not often.

Are Non-Stand-Replacing Processes Occur on the FMF?

Probably. Candidates include:

Montane. Historical low-intensity fires creating low density Doug. Fir and aspen stands. Detailed dendro study in progress to quantify.

Lower Foothills. Lower intensity fires and flooding maintaining boreal-type mixedwoods.

Selected areas of the Upper Foothills. Multiple-aged stands noted. Due to succession or other disturbance activities?

Disturbance Design Issues at Fine Scales

- **Area in island remnants is highly variable, but constant *on average* (4-20%).**
- **The number of islands increases with patch size.**
- **The largest island accounts for about 1/3 of the total island area. Most islands are less than 1 ha in size.**
- **Most islands are moderately disturbed.**
- **Edge and island locations can be *sometimes* be predicted with low to moderate probabilities.**
- **Most riparian corridors show little evidence of being differentially treated by fire, although ingress is evident.**

What Else at Fine Scales?

- **Biotic and abiotic influence on island / edge location**
- **Biotic and abiotic influence on burn severity**
- **More precise spatial analysis of interior areas of patches**
- **Riparian area response relationship to topography, pre-burn fuels, fire weather,…...**
- **Edge architecture**
- **Structural details of partially-burnt islands**
- **Other disturbance impacts, including surface fires**
- **Dead and live standing**

….. Etc.