



# Trade-offs in multi-objective hatchery mitigation programs: You can have your fish and eat them too (but not as many as you may want)

Peter Graf, Grant County PUD

AFS WA/BC


Kelowna, BC



Grant County  
**PUBLIC UTILITY DISTRICT**



1. Hatcheries can serve multiple purposes
2. 'Multiple Use' is not unique to hatchery management
3. Economics has a tool to help
4. Multiple objectives can be complimentary, but ultimately involve trade-offs
5. Choices and trade-offs occur at all levels of decision-making
6. We need to acknowledge trade-offs



*“The goal of the program is the restoration of naturally reproducing populations of spring Chinook in their native habitats using locally adapted broodstock, while maintaining genetic and ecologic integrity, and supporting harvest. The purpose is to meet No Net Impact (NNI) mitigation goals...in a manner consistent with overall objectives of rebuilding natural populations.”*

-Upper Columbia Spring Chinook HGMP





Siuslaw River

Siuslaw Falls  
County Park

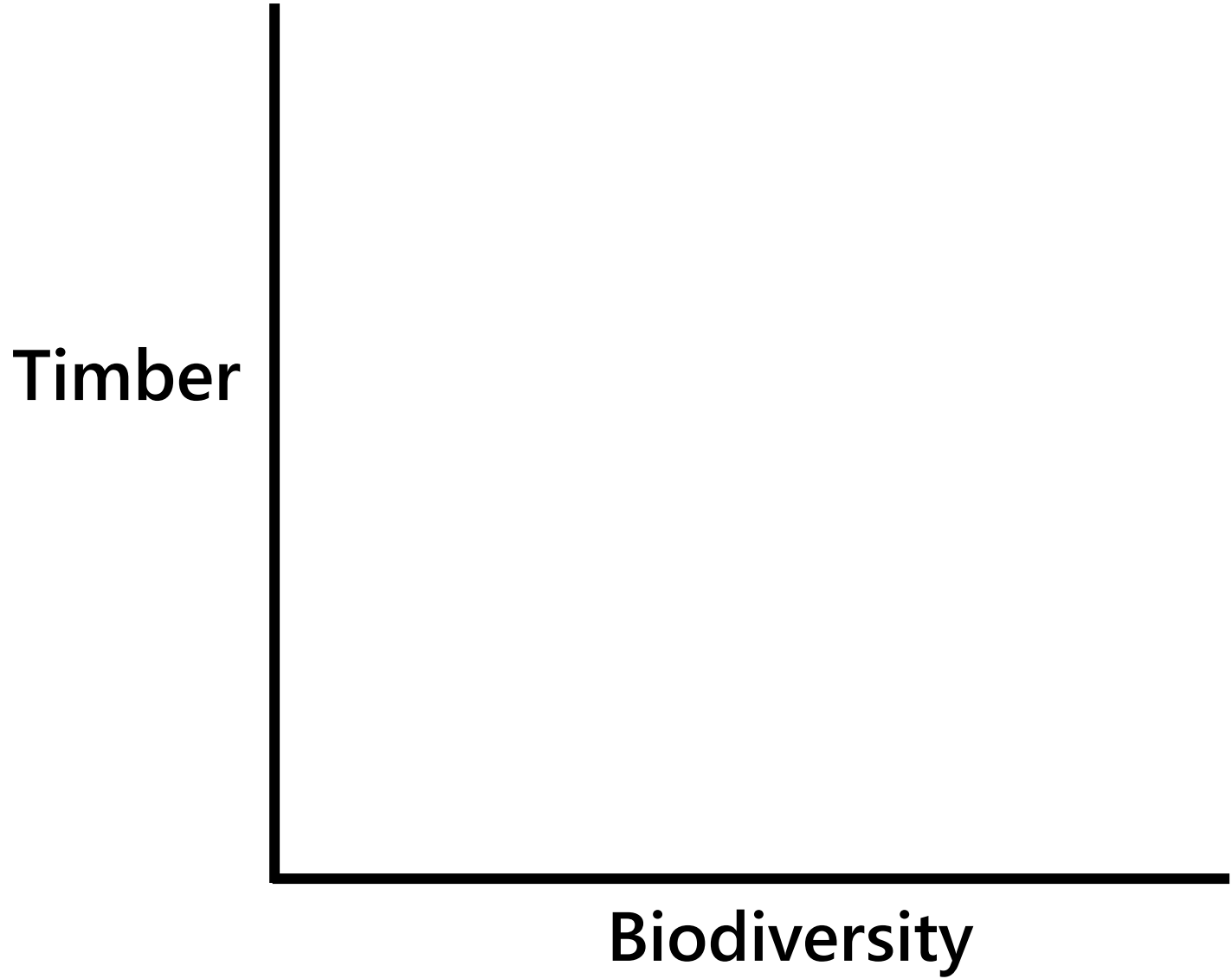
Siuslaw River

Gunter

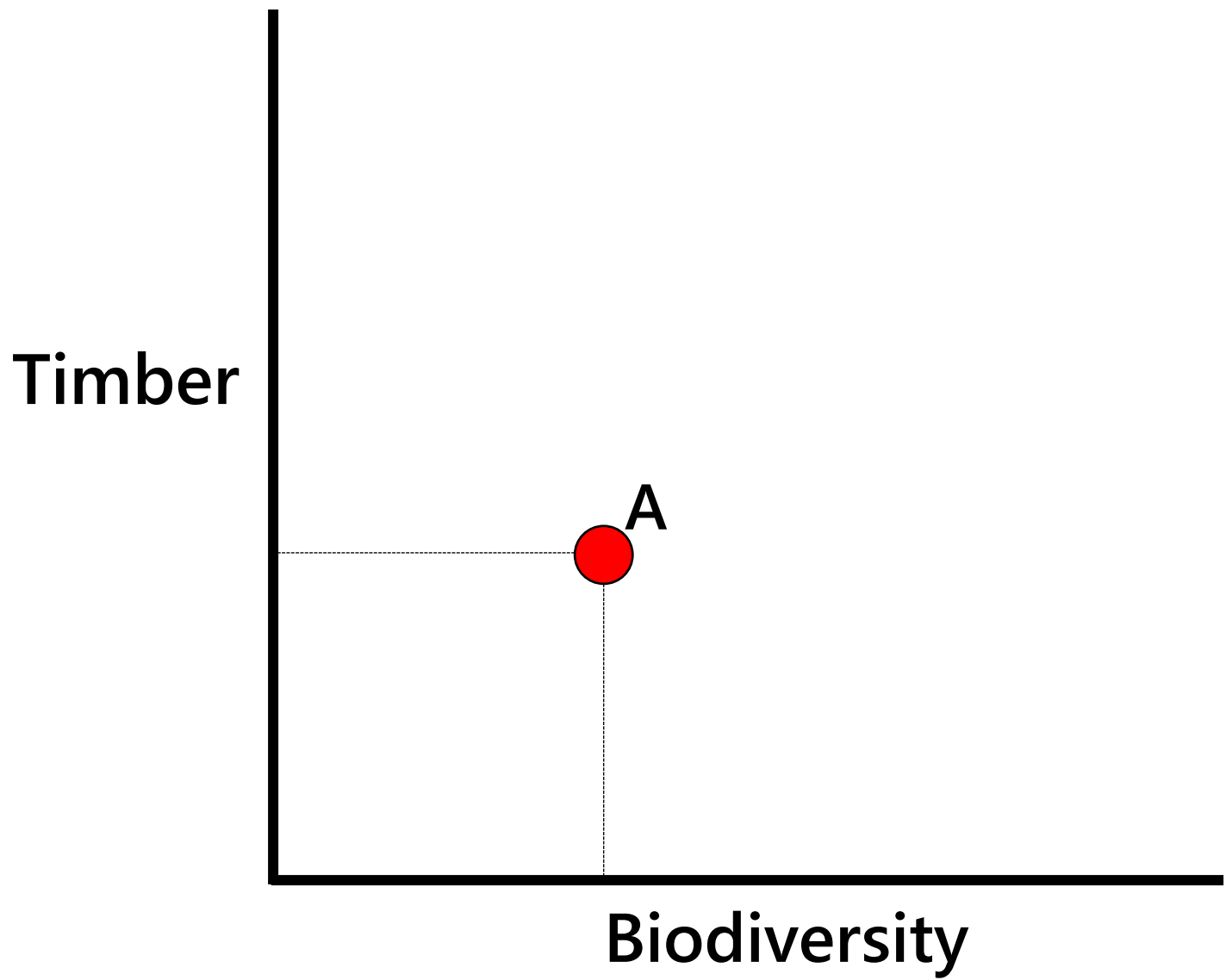
Google



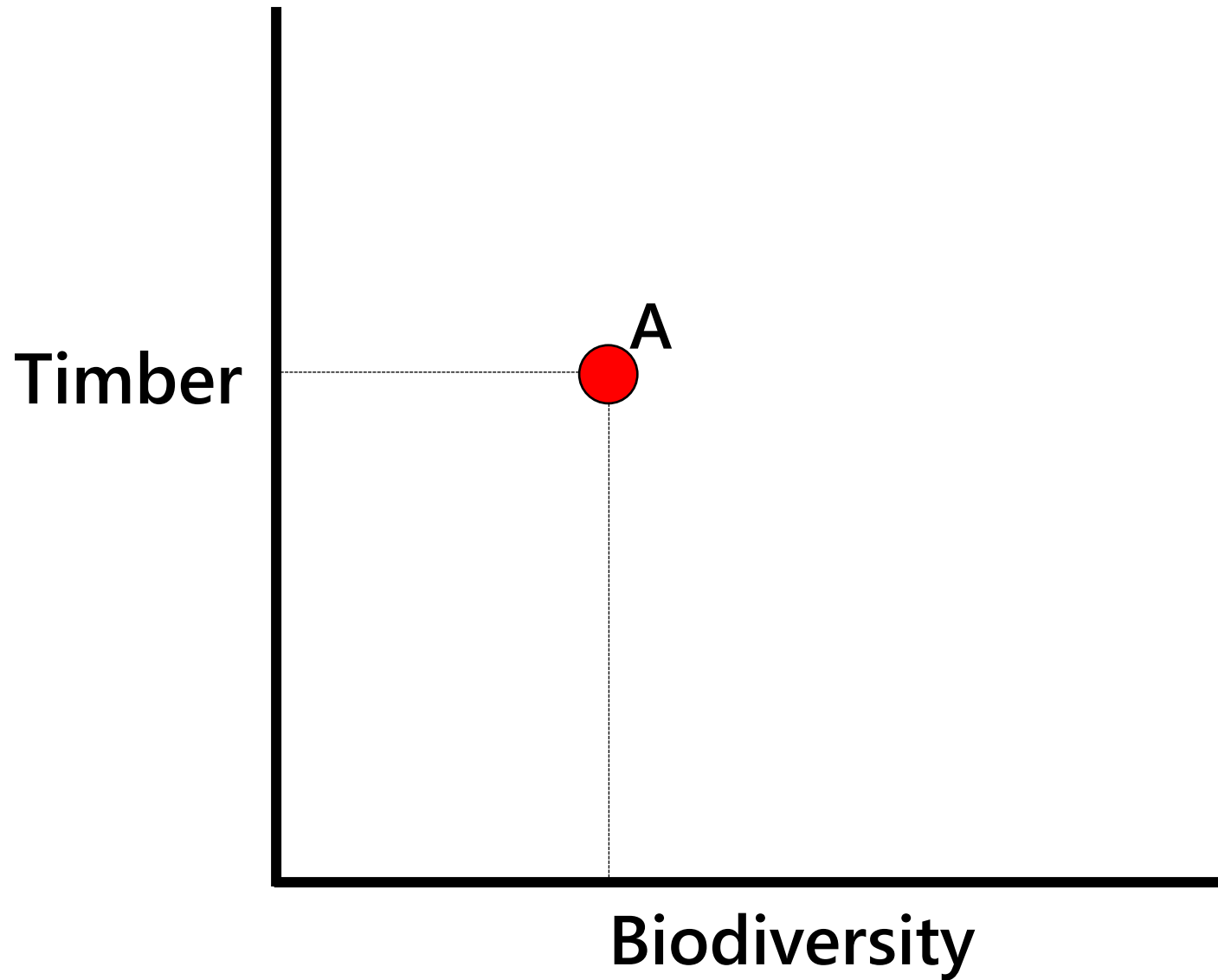
# Production Possibility Frontier (PPF)



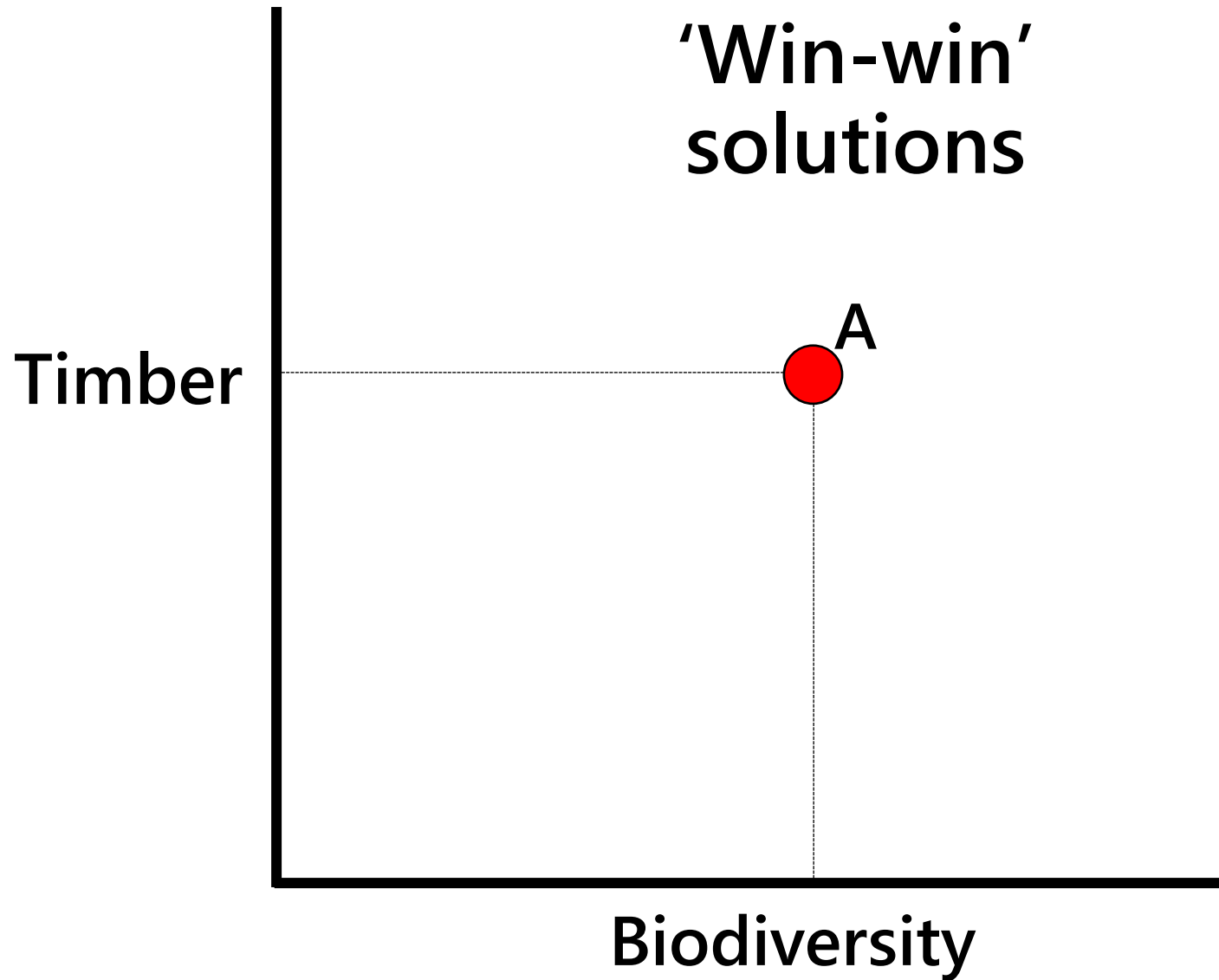
# Production Possibility Frontier (PPF)



# Production Possibility Frontier (PPF)

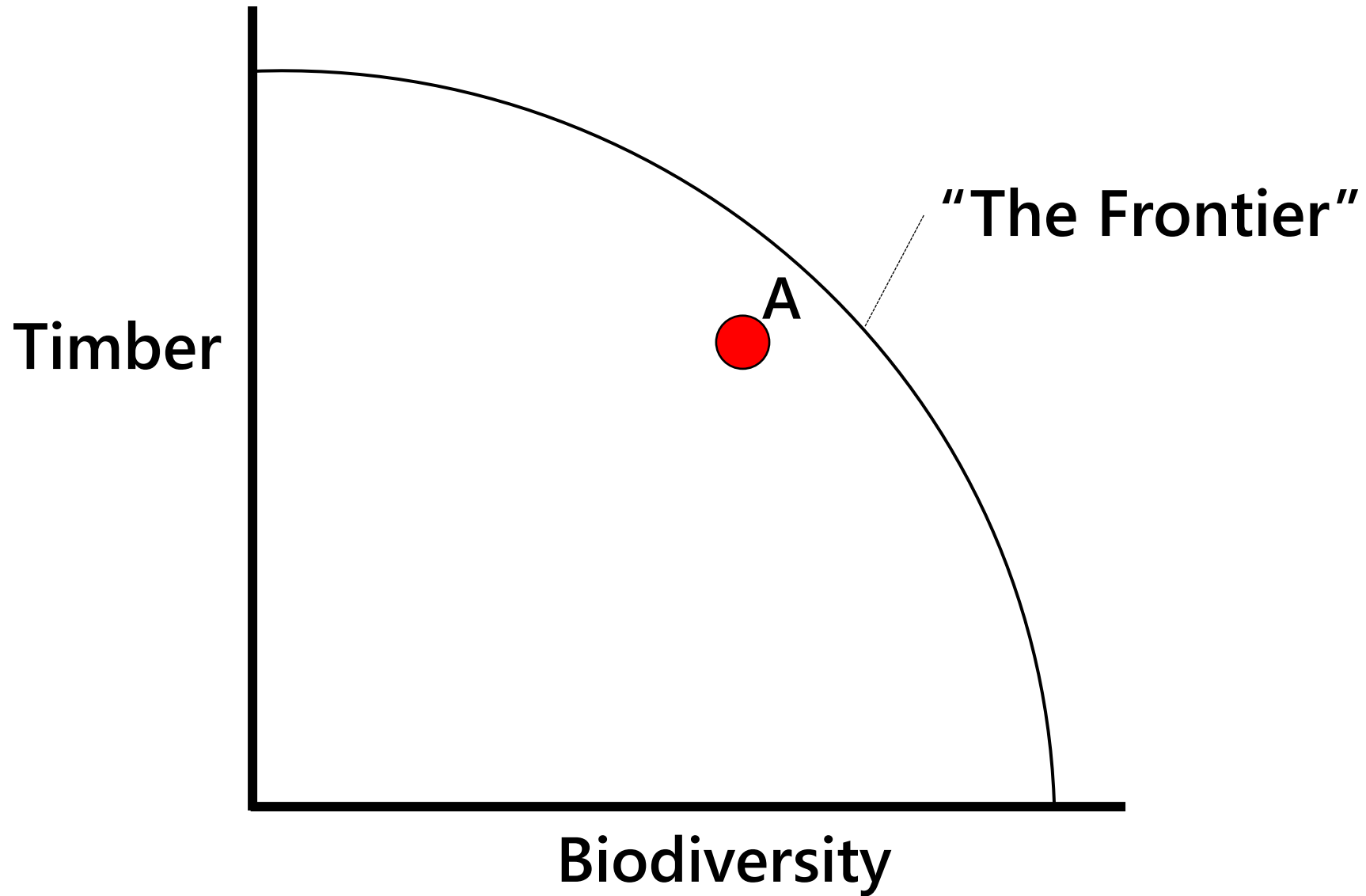


# Production Possibility Frontier (PPF)

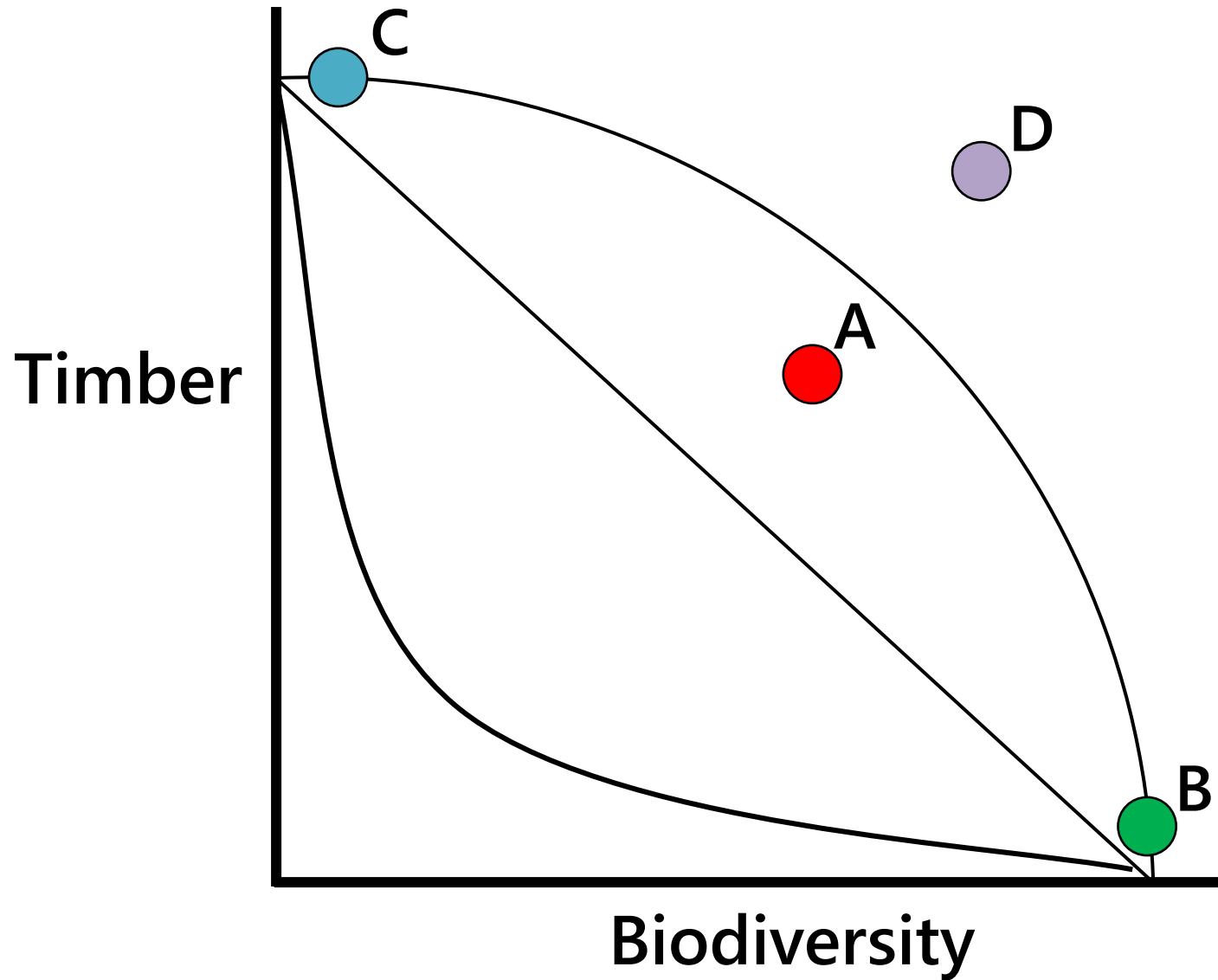




# Production Possibility Frontier (PPF)



# Production Possibility Frontier (PPF)



# Trade-offs at multiple scales:

- 1. Policy (conservation, harvest, mitigation)**
- 2. Regional (hatchery program size and escapement)**
- 3. Program (fish growth and size)**

# Hatchery Scientific Review Group Review and Recommendations

## Wenatchee River Spring Chinook Population And Related Hatchery Programs

January 31, 2009

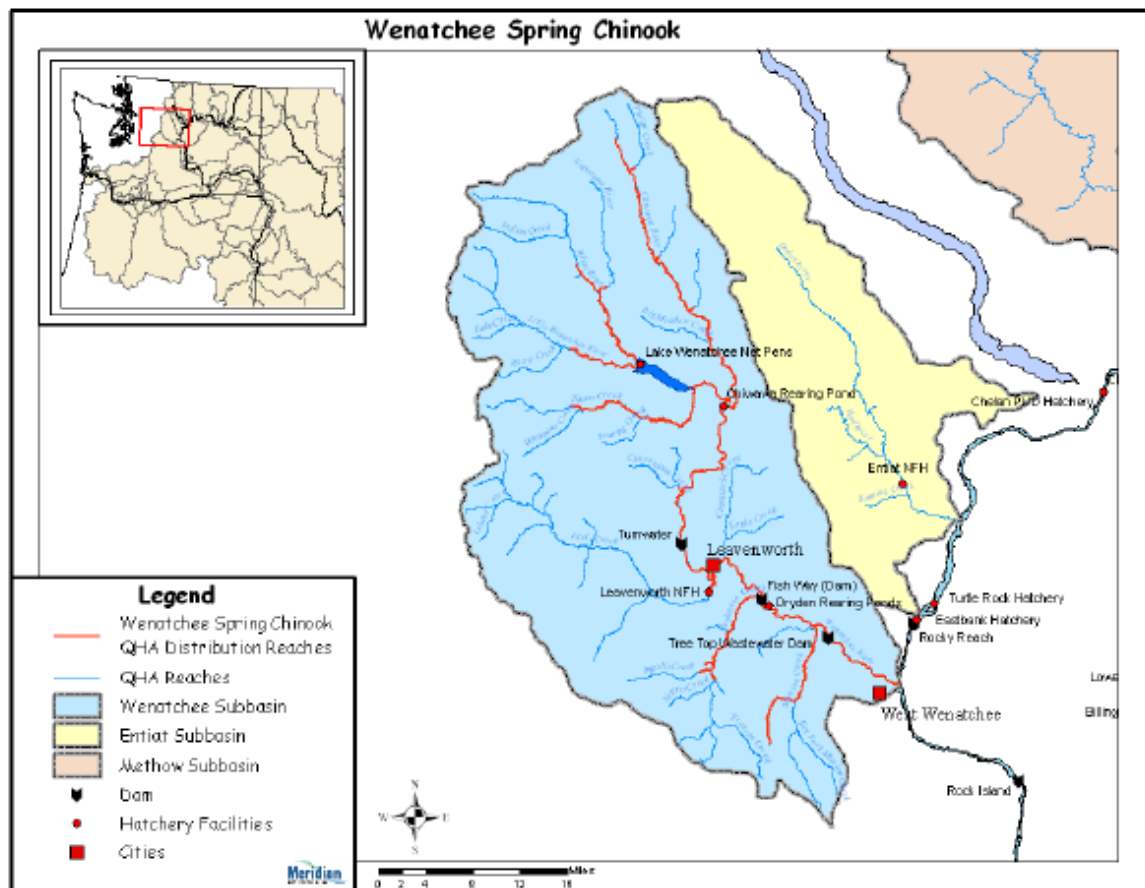
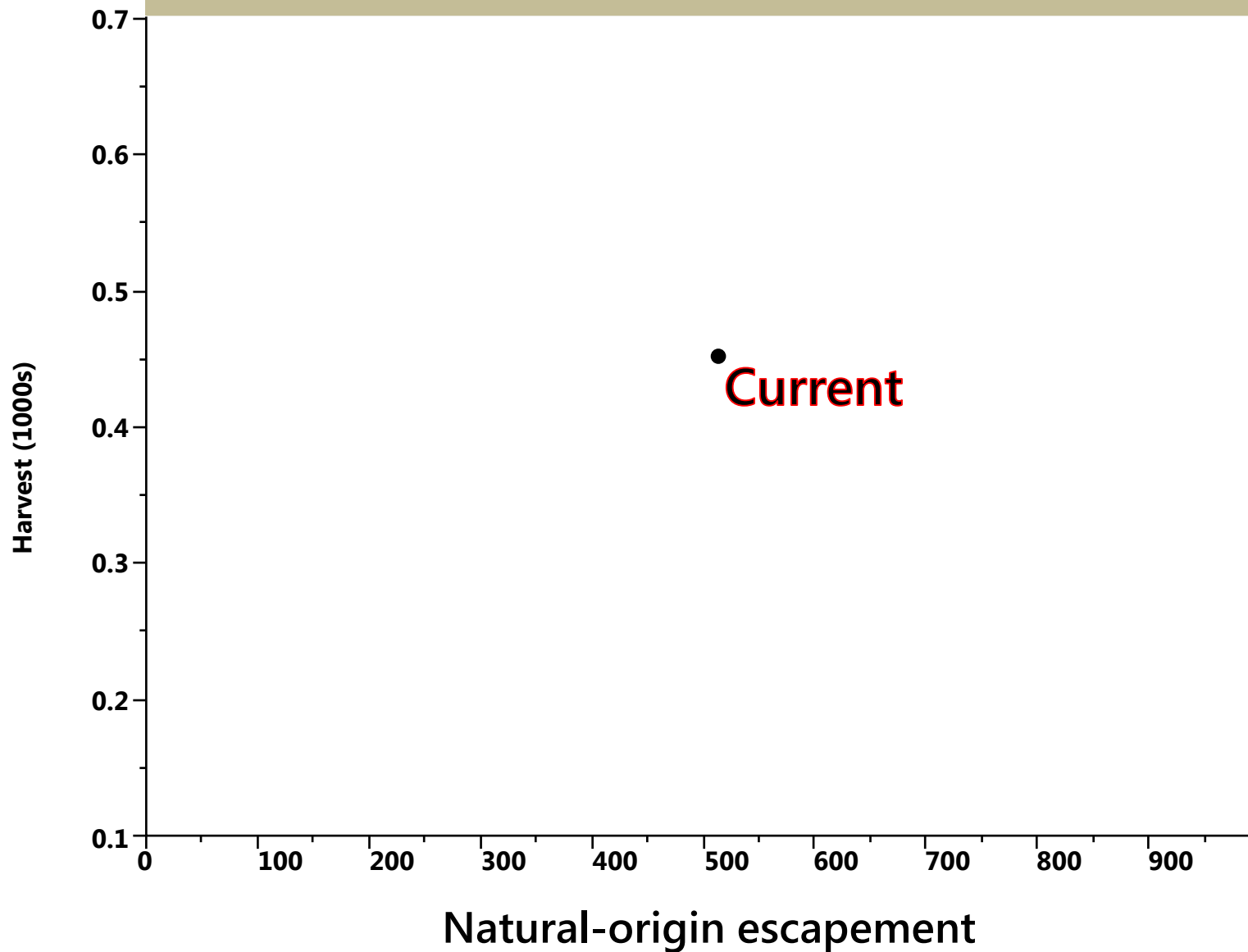


Table 1. Results of HSRG analysis of current condition and HSRG Solution for Wenatchee Spring Chinook. The light green row indicates the natural population and yellow indicates the segregated hatchery population, if applicable. A 10% habitat improvement is applied to the HSRG Solution to evaluate the additional effect of improved habitat towards conservation objectives.

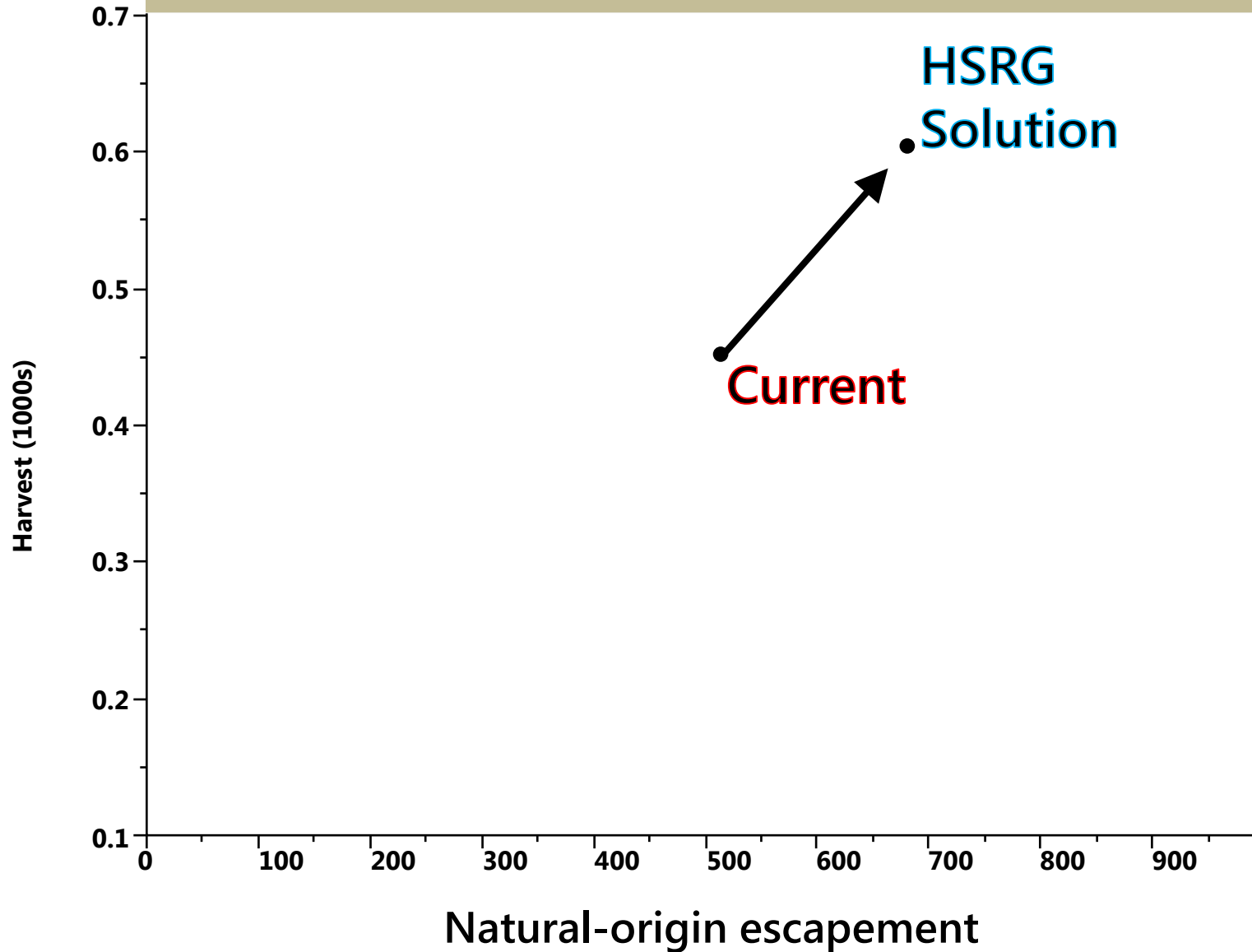
Alternative	Type and Purpose	Prog Size (/1000)	HOR Recapture	Additional Weir Efficiency	Effective pHOS	PNI	NOS Esc	Adj Prod	Harvest	Hatchery Surplus
Current	Nasson Int Cons	-	0%	0%	26%	0.00	107	1.2	16	0
	Chiwawa Int Cons	351.5	30%	0%	75%	0.32	277	2.3	389	275
	White Int Cons	65.9	0%	0%	43%	0.00	130	2.1	46	1
	Leavenworth Seg Harv	1,650.2	98%						1,655	491
No Hatchery	Nasson None	-	0%	0%	0%	1.00	245	2.7	37	-
	Chiwawa None	-	0%	0%	0%	1.00	502	4.8	76	-
	White None	-	0%	0%	0%	1.00	211	4.6	32	-
HSRG Solution	Nasson Int Cons	149.1	35%	85%	29%	0.54	131	1.9	179	526
	Chiwawa Int Cons	149.1	35%	85%	12%	0.79	425	4.4	225	538
	White Int Cons	149.1	35%	85%	32%	0.51	126	3.2	200	608
	Leavenworth Seg Harv	2,475.3	98%						2,699	904
HSRG Solution w/ Improved Habitat	Nasson Int Cons	149.1	35%	85%	22%	0.60	184	2.2	187	526
	Chiwawa Int Cons	149.1	35%	85%	11%	0.81	491	4.9	235	538
	White Int Cons	149.1	35%	85%	27%	0.55	156	3.7	204	608
	Leavenworth Seg Harv	2,475.3	98%						2,699	904



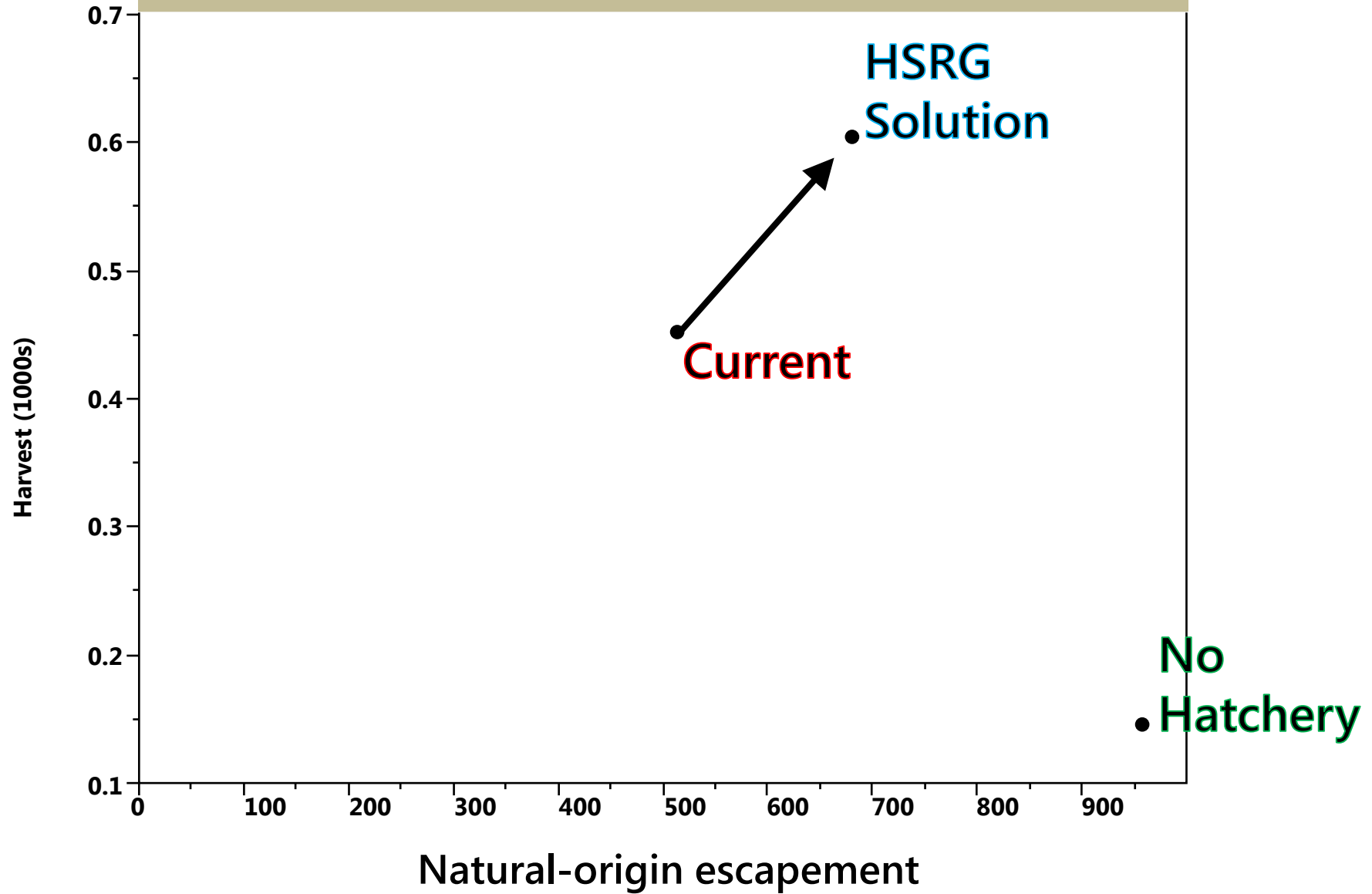
# Wenatchee Spring Chinook



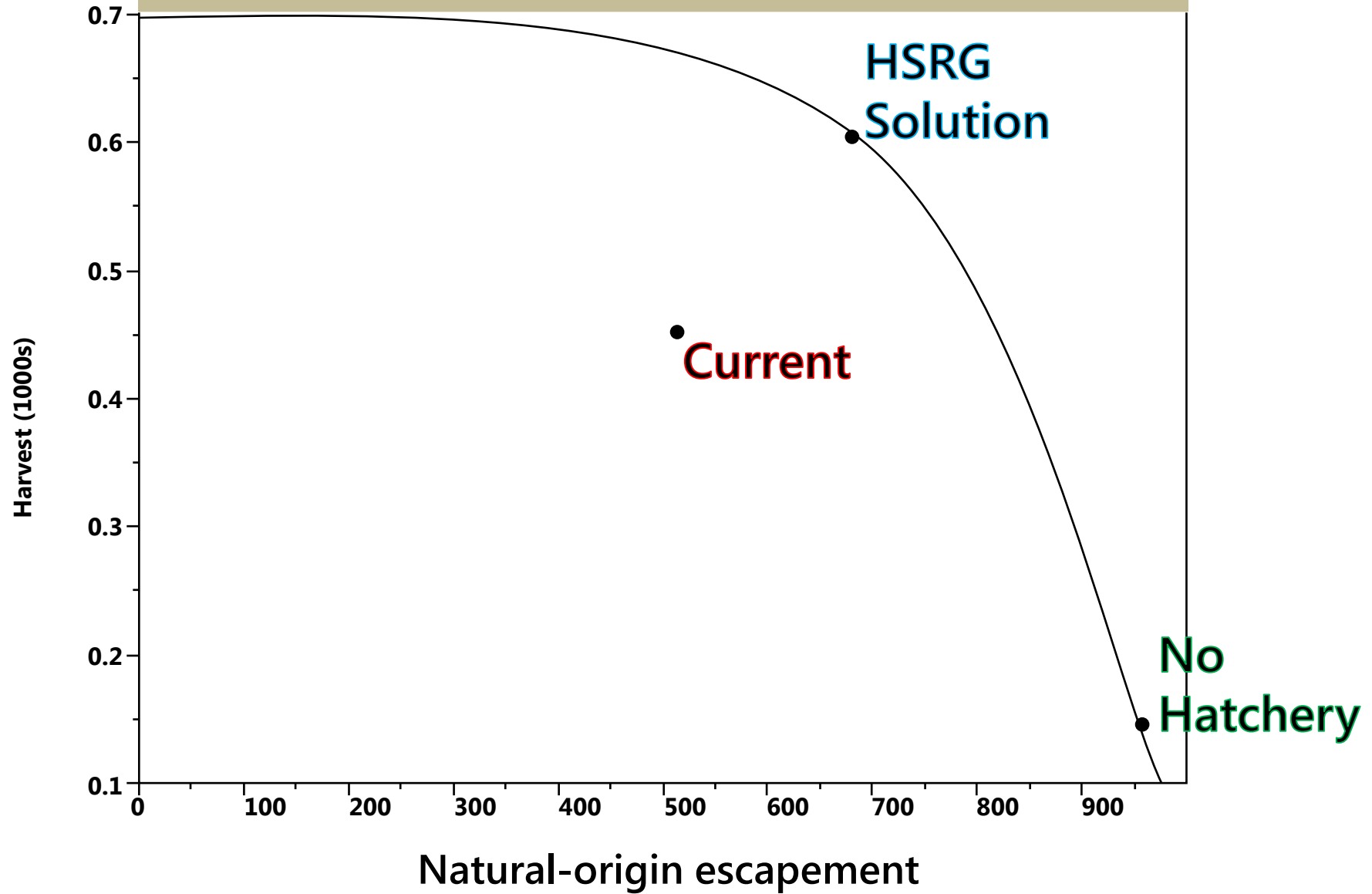
# Wenatchee Spring Chinook



# Wenatchee Spring Chinook

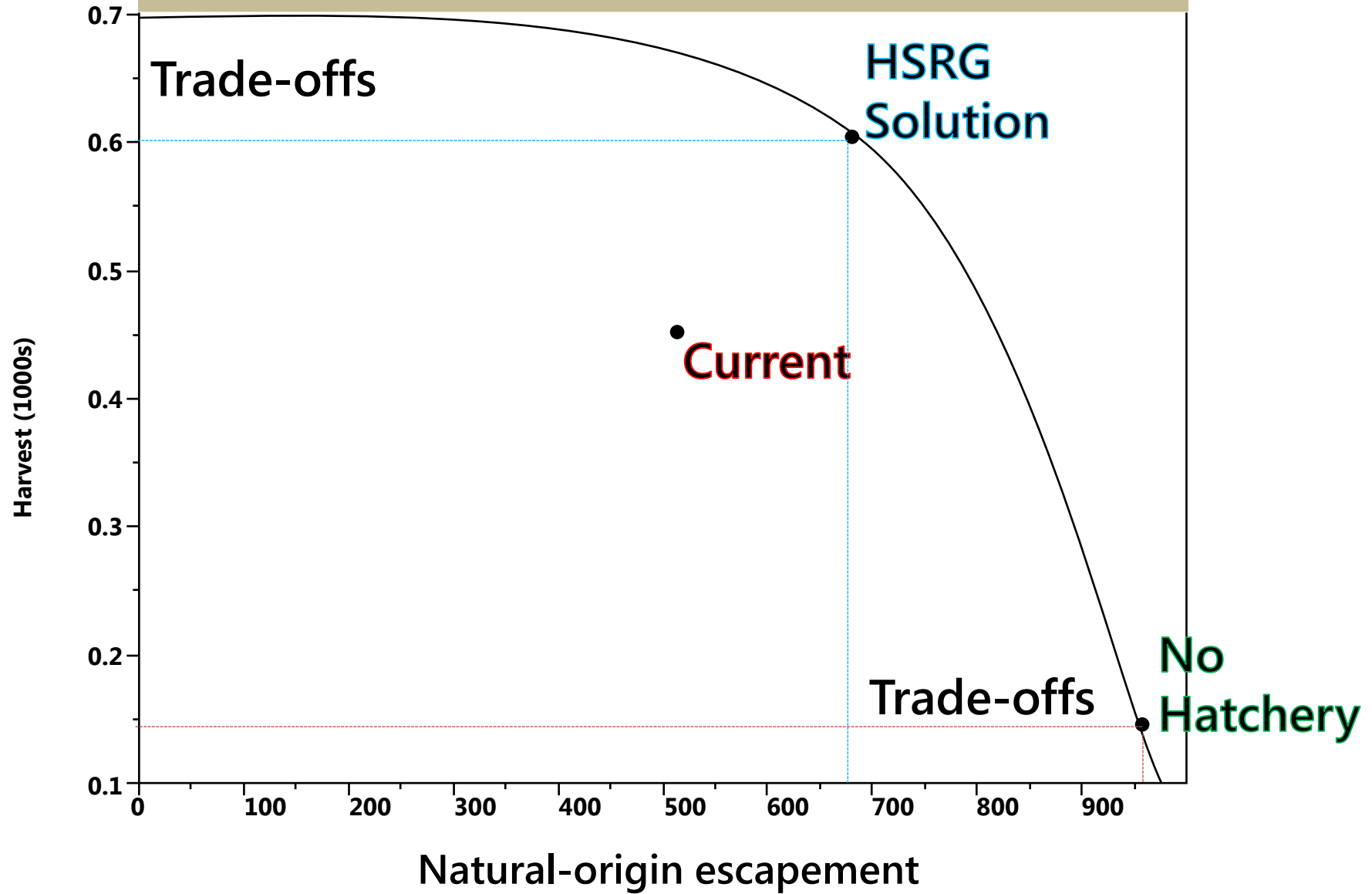


# Wenatchee Spring Chinook

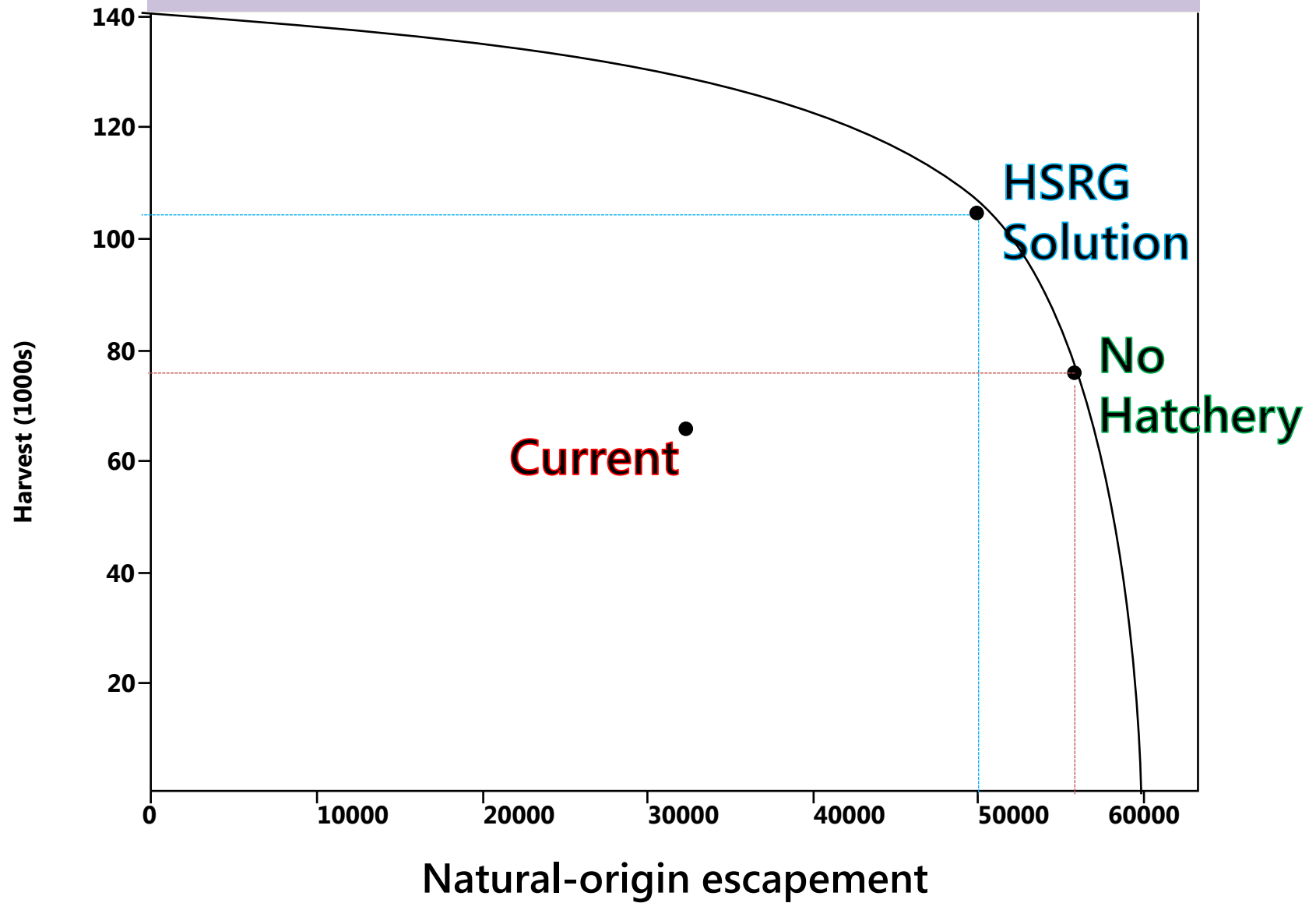




# Wenatchee Spring Chinook



# Hanford Reach Fall Chinook



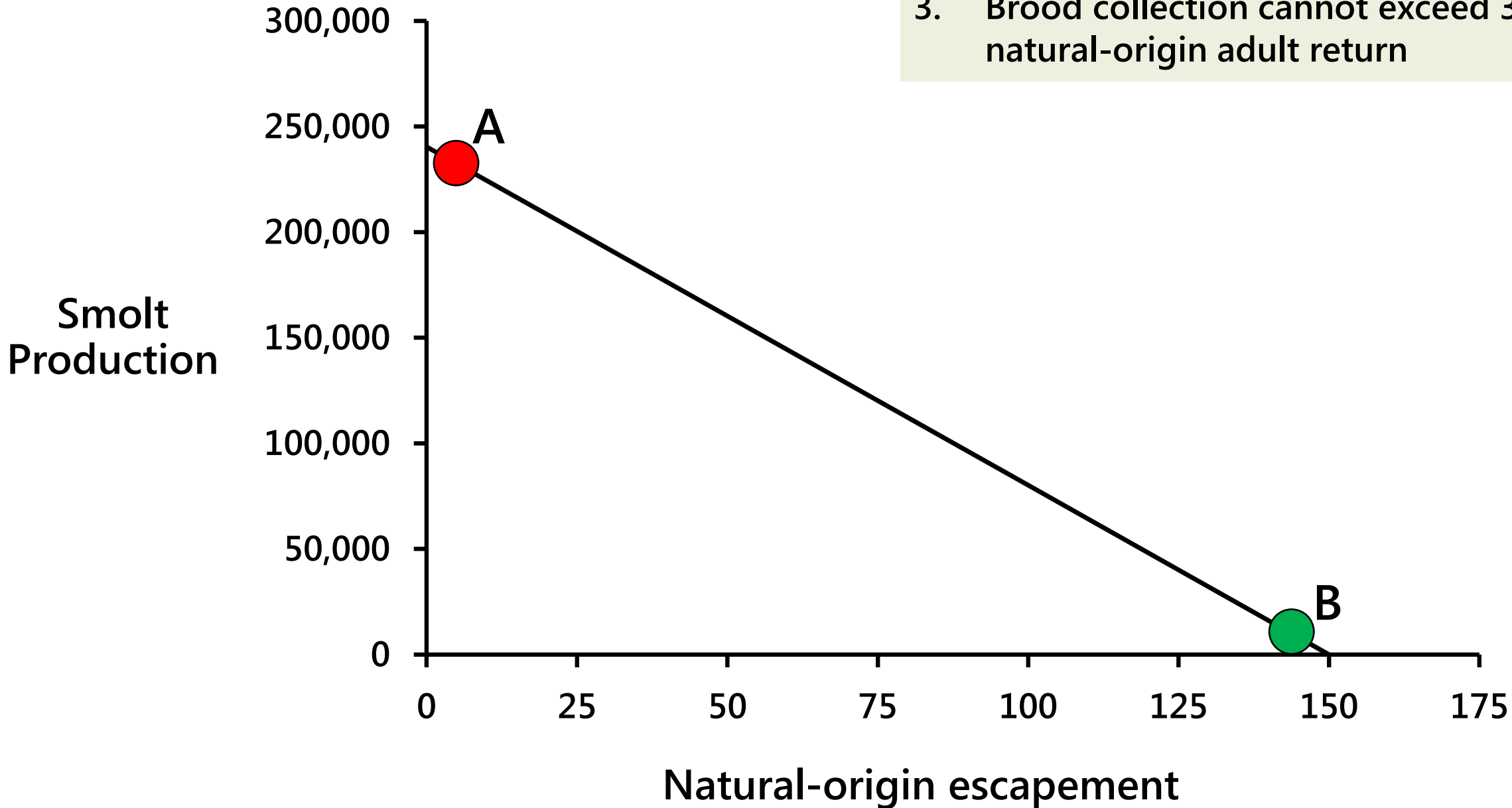
# Regional Scale

# Nason Creek Spring Chinook Conservation Program:

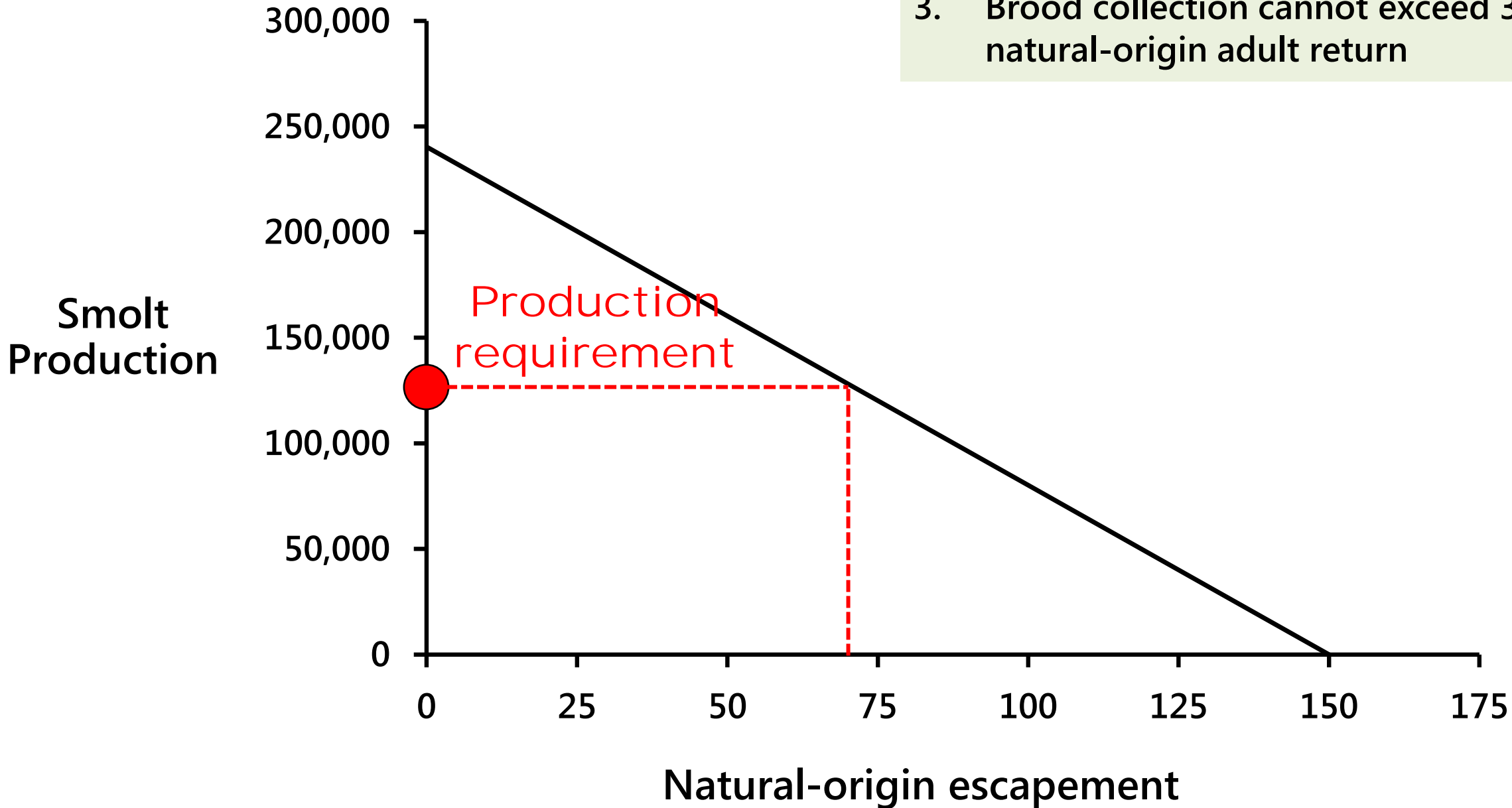
1. Smolt Requirement = 125,000
2. Natural-origin Adults Required = 78
3. Brood collection cannot exceed 33% of natural-origin adult return



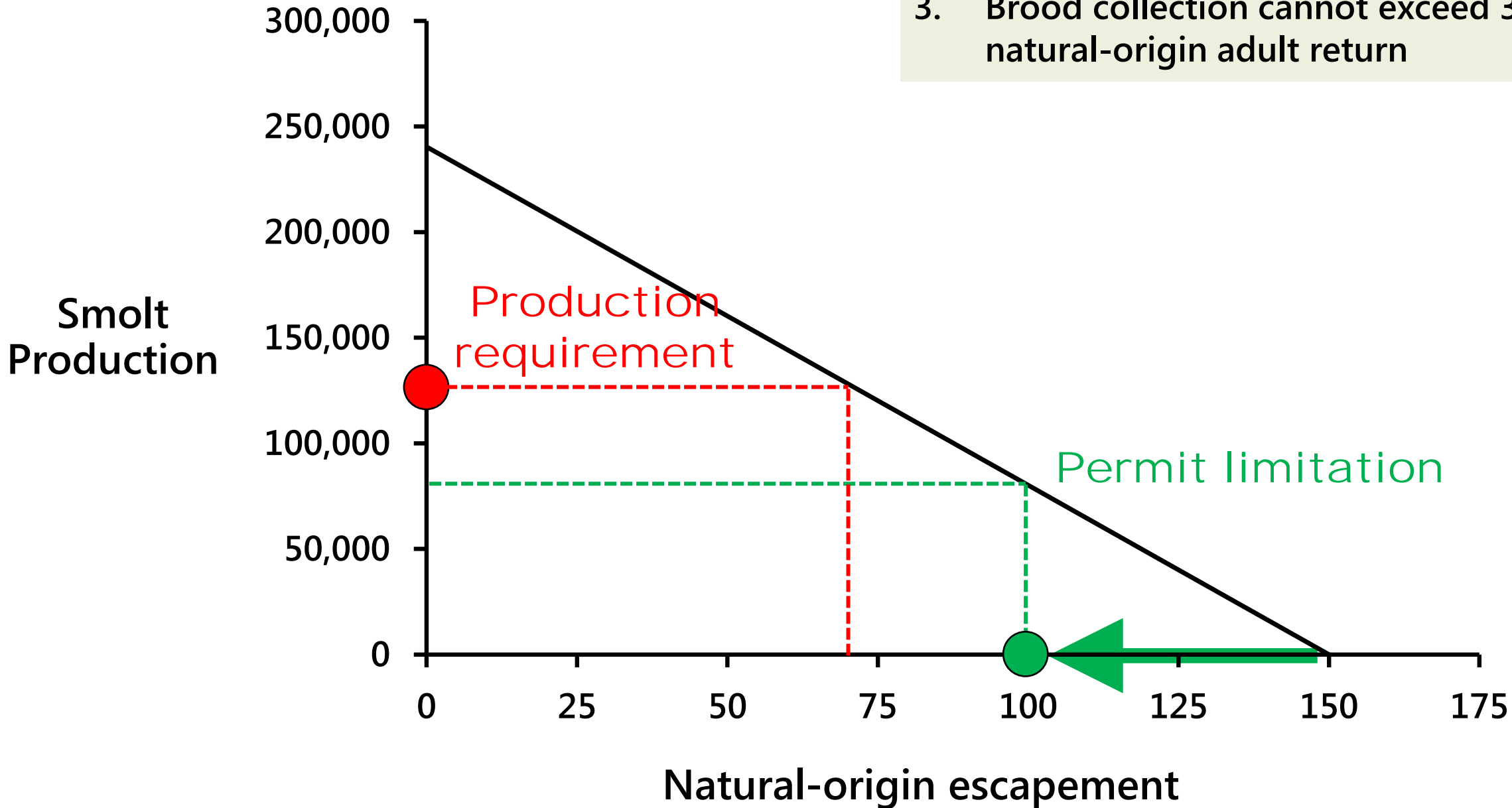
1. Smolt Release Requirement = 125,000
2. Natural-origin Adult Required = 78
3. Brood collection cannot exceed 33% of natural-origin adult return



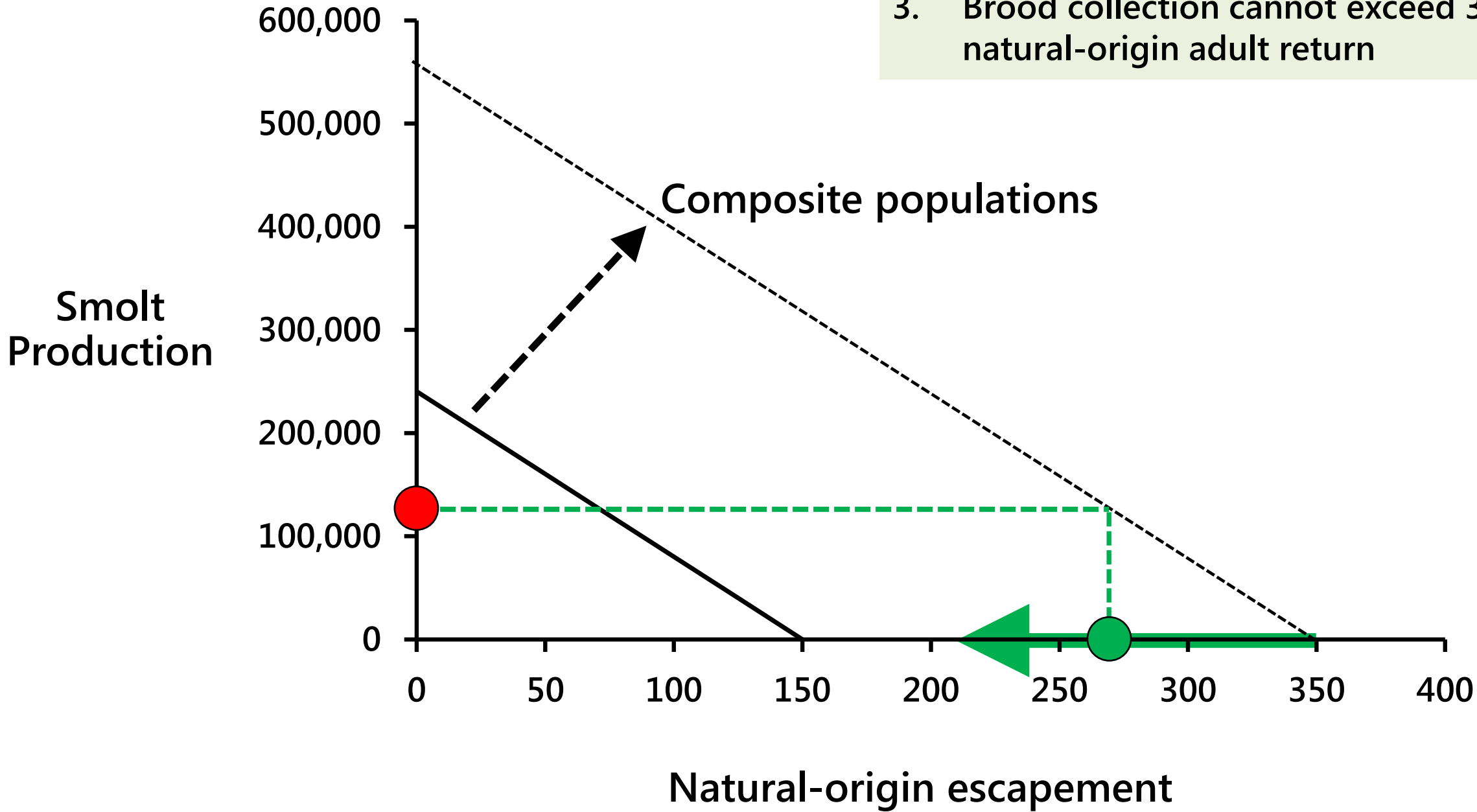
- 1. Smolt Release Requirement = 125,000
- 2. Natural-origin Adult Required = 78
- 3. Brood collection cannot exceed 33% of natural-origin adult return



- 1. Smolt Release Requirement = 125,000
- 2. Natural-origin Adult Required = 78
- 3. Brood collection cannot exceed 33% of natural-origin adult return



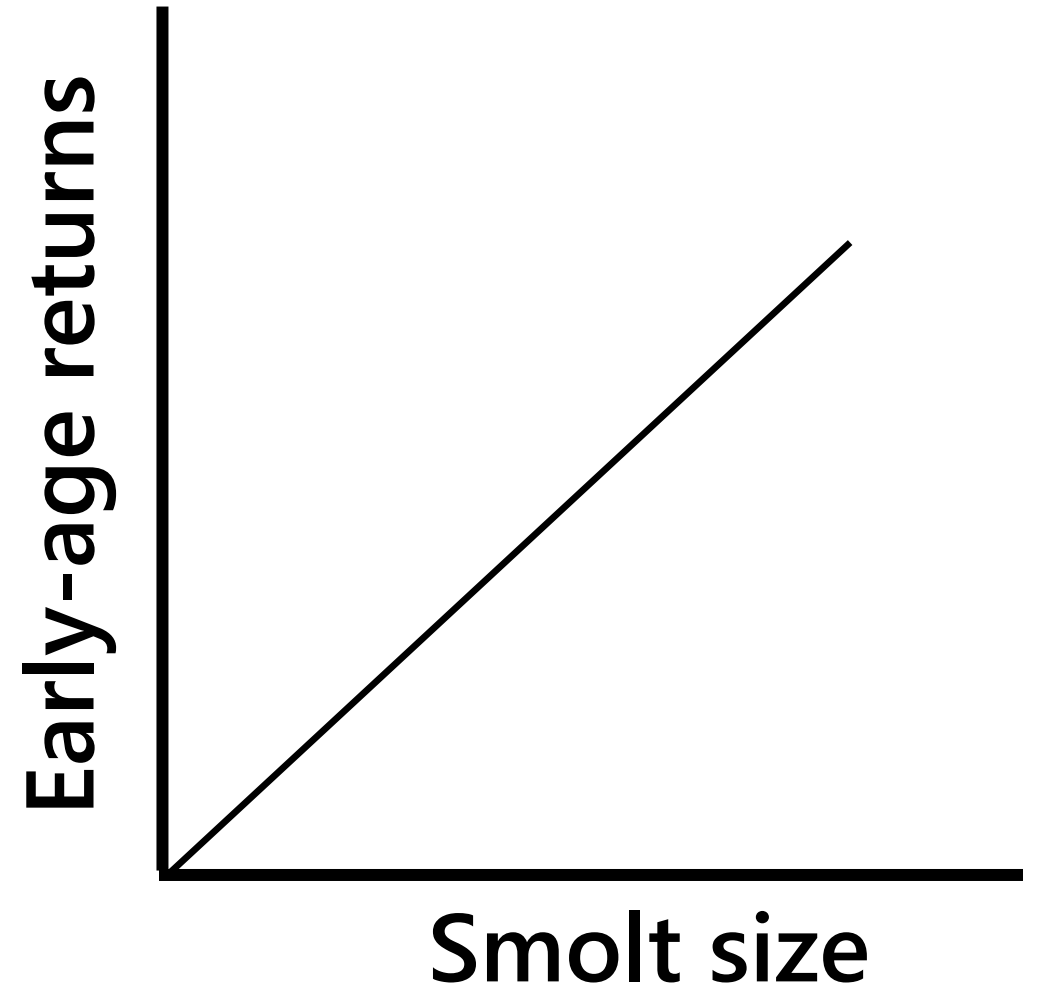
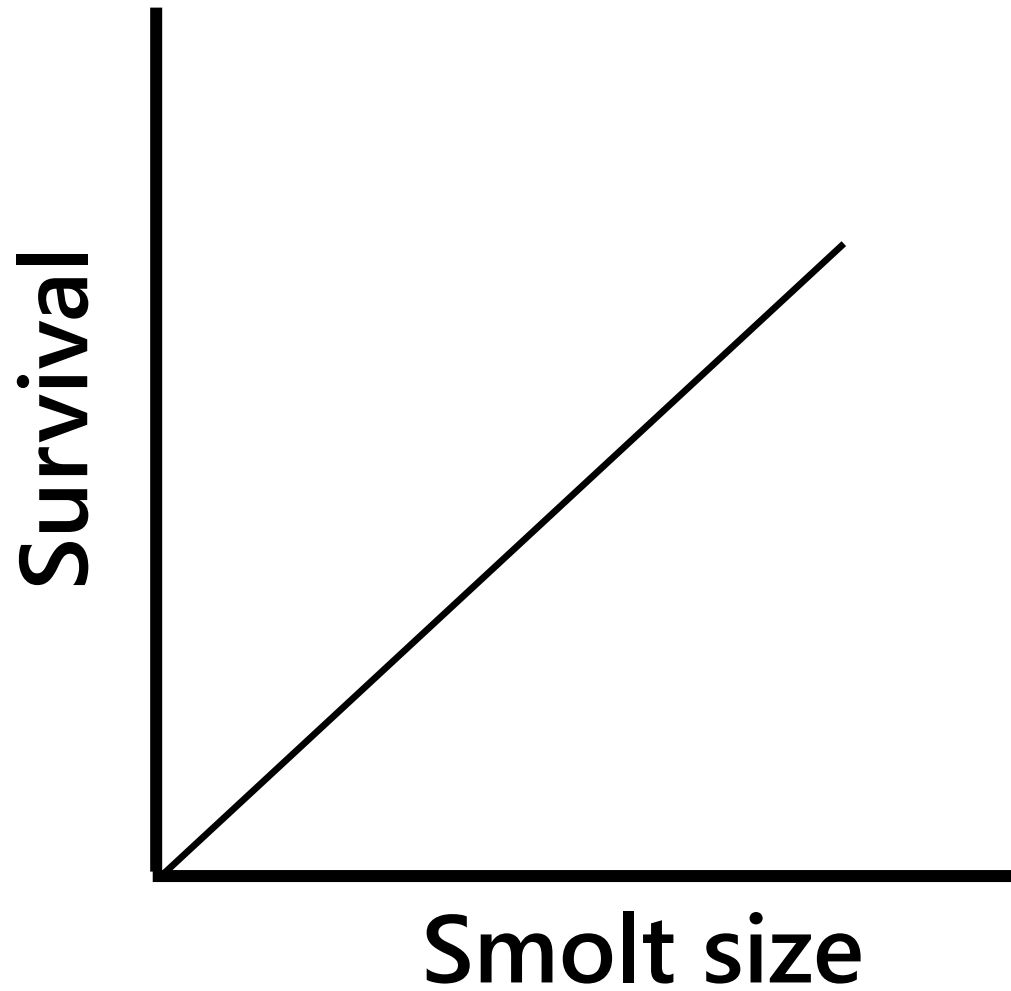
- 1. Smolt Release Requirement = 125,000
- 2. Natural-origin Adult Required = 78
- 3. Brood collection cannot exceed 33% of natural-origin adult return



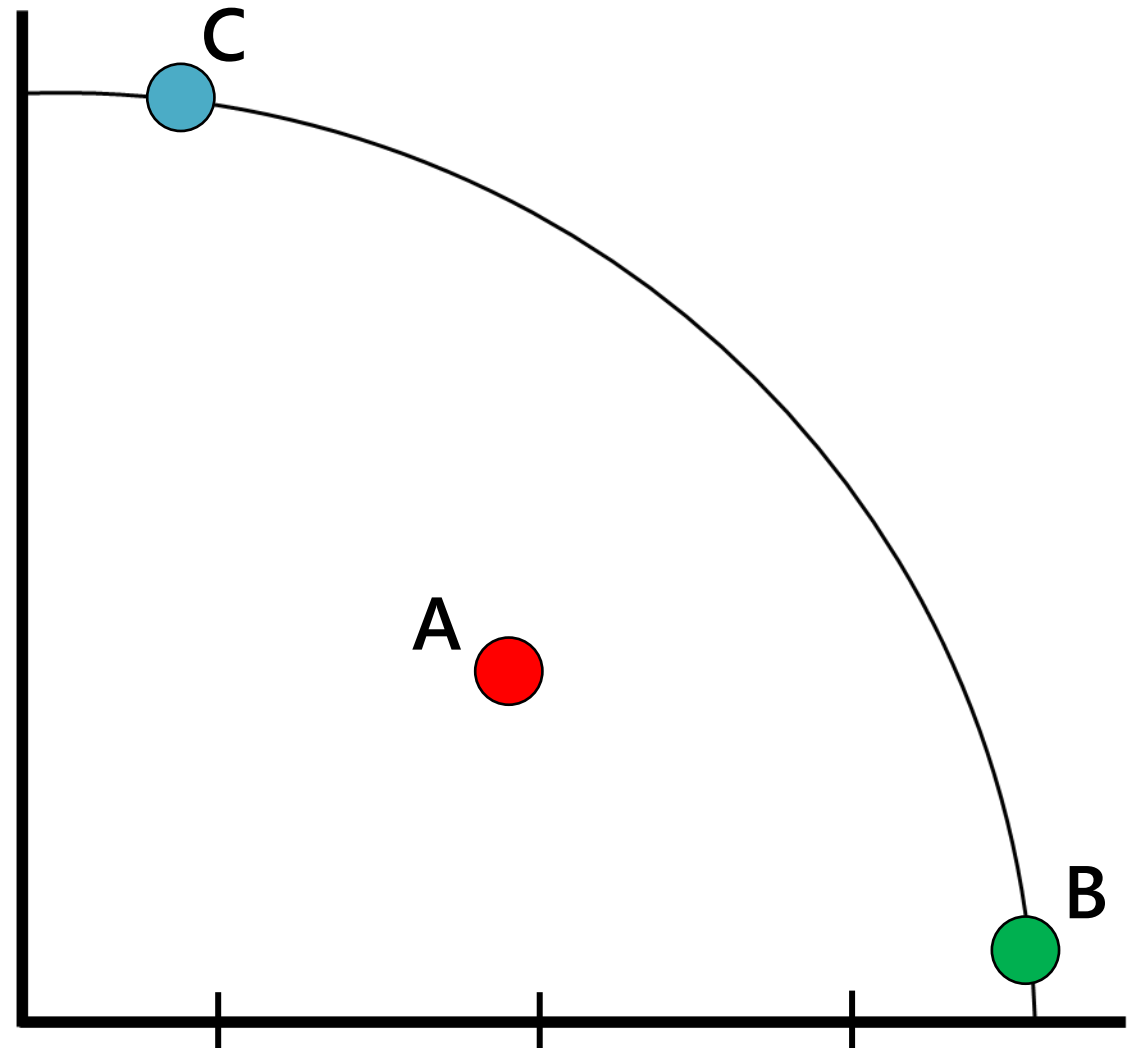


# Program Scale

# Smolt size, survival, and age at return

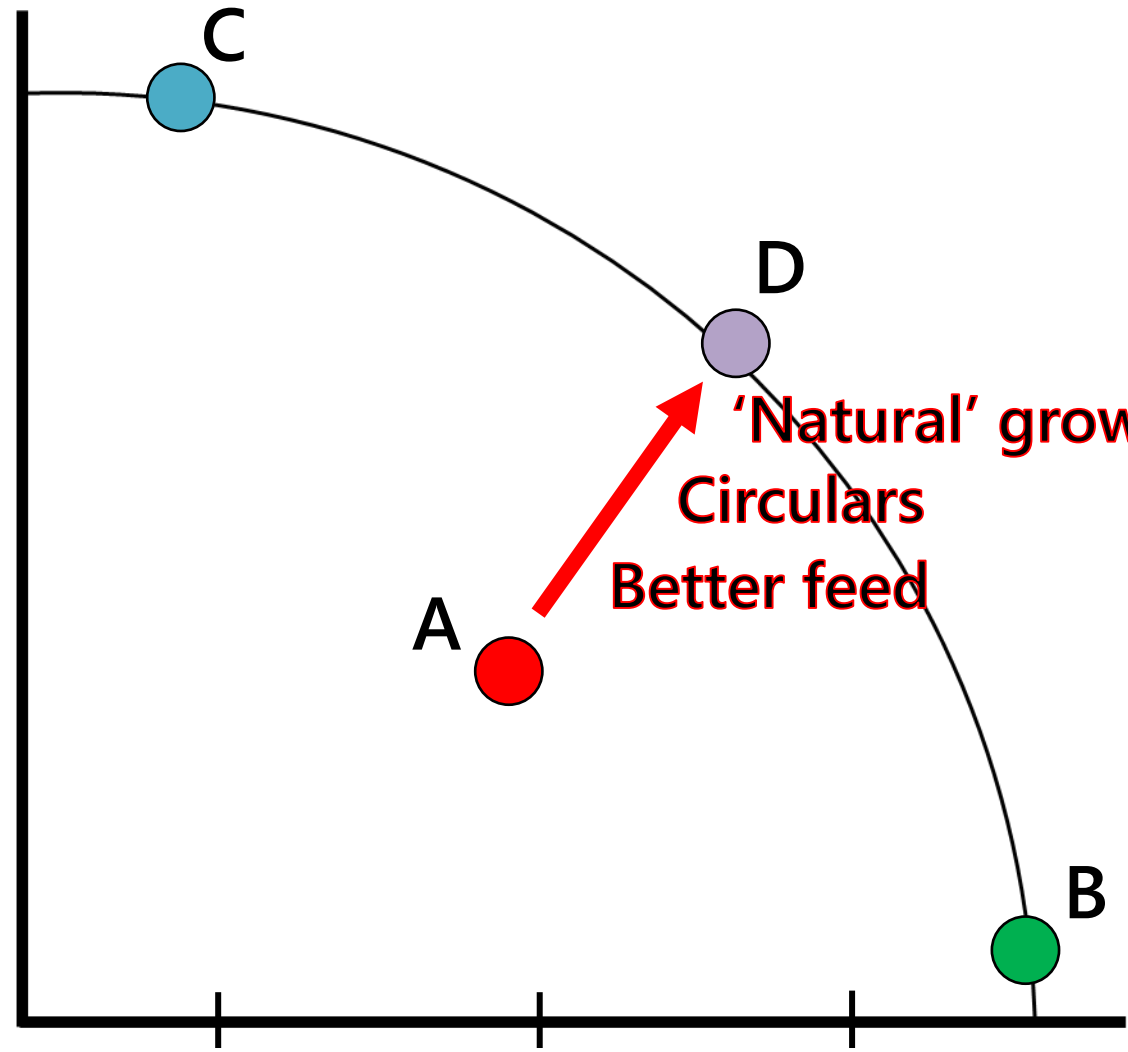


Natural age  
class  
distribution



Survival / Smolt Size

# Natural age class distribution



Survival / Smolt Size

- 1. Hatcheries have limits.**
- 2. Are we at the frontier?**
- 3. 'Win-wins' are hard, reality is often 'win-lose'.**
- 4. Trade-offs need not imply conflict.**
- 5. Evaluate performance based on the choices that have we've made.**



*Essay*

## Acknowledging Conservation Trade-Offs and Embracing Complexity

PAUL D. HIRSCH,<sup>\*</sup> WILLIAM M. ADAMS,<sup>†</sup> J. PETER BROSIUS,<sup>‡</sup> ASIM ZIA,<sup>§</sup> NINO BARIOLA,<sup>\*\*·‡‡</sup>  
AND JUAN LUIS DAMMERT<sup>††·‡‡</sup>



ELSEVIER

Contents lists available at [ScienceDirect](#)

Biological Conservation

journal homepage: [www.elsevier.com/locate/biocon](http://www.elsevier.com/locate/biocon)



Hard choices: Making trade-offs between biodiversity conservation and human well-being

Thomas O. McShane<sup>a,\*</sup>, Paul D. Hirsch<sup>b</sup>, Tran Chi Trung<sup>c</sup>, Alexander N. Songorwa<sup>d</sup>, Ann Kinzig<sup>e</sup>,  
Bruno Monteferri<sup>f</sup>, David Mutekanga<sup>g</sup>, Hoang Van Thang<sup>c</sup>, Juan Luis Dammert<sup>f</sup>, Manuel Pulgar-Vidal<sup>f</sup>,  
Meredith Welch-Devine<sup>h</sup>, J. Peter Brosius<sup>h</sup>, Peter Coppolillo<sup>g</sup>, Sheila O'Connor<sup>a</sup>

End