

**Solution: Using EFM with 2D river hydraulics model output**

Defining EFM Relationships

<i>Statistical Settings</i>	<b>Veg - Percent time inundated</b>
Season	2/1 to 7/31
Duration	1 day
% Exceedance	Flow duration
Reverse lookup (stage, value)	0.041667 feet (0.5 inches)
Handle out of range with 0/100	on

<i>Statistical Settings</i>	<b>Salmon HSI - 0.1to1</b>
Season	2/1 to 6/30 (150 days)
Duration	1 day
% Exceedance	Flow duration
Reverse lookup (stage, range)	0.1 to 1 feet
Handle out of range with 0/100	On

<i>Statistical Settings</i>	<b>Salmon HSI - 1to2</b>
Season	2/1 to 6/30 (150 days)
Duration	1 day
% Exceedance	Flow duration
Reverse lookup (stage, range)	1 to 2 feet
Handle out of range with 0/100	On

<i>Statistical Settings</i>	<b>Salmon HSI - 2to3</b>
Season	2/1 to 6/30 (150 days)
Duration	1 day
% Exceedance	Flow duration
Reverse lookup (stage, range)	2 to 3 feet
Handle out of range with 0/100	On

Modeling Logic: Percent Time Inundated (early growing season) for Vegetation										
	Open Water		Emergent Wetlands		Low Woody Veg		Floodplain Riparian		Upland	
	Start	End	Start	End	Start	End	Start	End	Start	End
Values	100	93	93	60	60	30	30	10	10	0

Modeling Logic: Suitabilities for Salmon Rearing										
	Suit = 0		Suit = 0.5		Suit = 1		Suit = 0.5		Suit = 0	
	Start	End	Start	End	Start	End	Start	End	Start	End
Depth	0.0	0.1	0.1	1.0	1.0	2.0	2.0	3.0	3.0	>3.0

### Analyzing EFM Results in Spreadsheet

Vegetation habitat area table.

<i>Habitat Types</i>	Existing (ac)	Restored (ac)	Change (ac)	Percent Change
Open Water	0.12	0.06	-0.06	-51%
Emergent Wetlands	34.25	34.23	-0.02	0%
Low Woody Shrub	21.10	27.54	6.44	31%
Floodplain Riparian	31.75	30.76	-1.00	-3%
Upland Terrestrial	96.00	90.64	-5.36	-6%

1) Which habitat type gained the most area in West Rook?

At +6.44 acres, low woody shrub gained the most area.

2) Which habitat type lost the most area in West Rook?

At -5.36 acres, upland terrestrial lost the most area.

3) Waterfowl are common in the restoration area. Emergent wetlands are their preferred habitat.

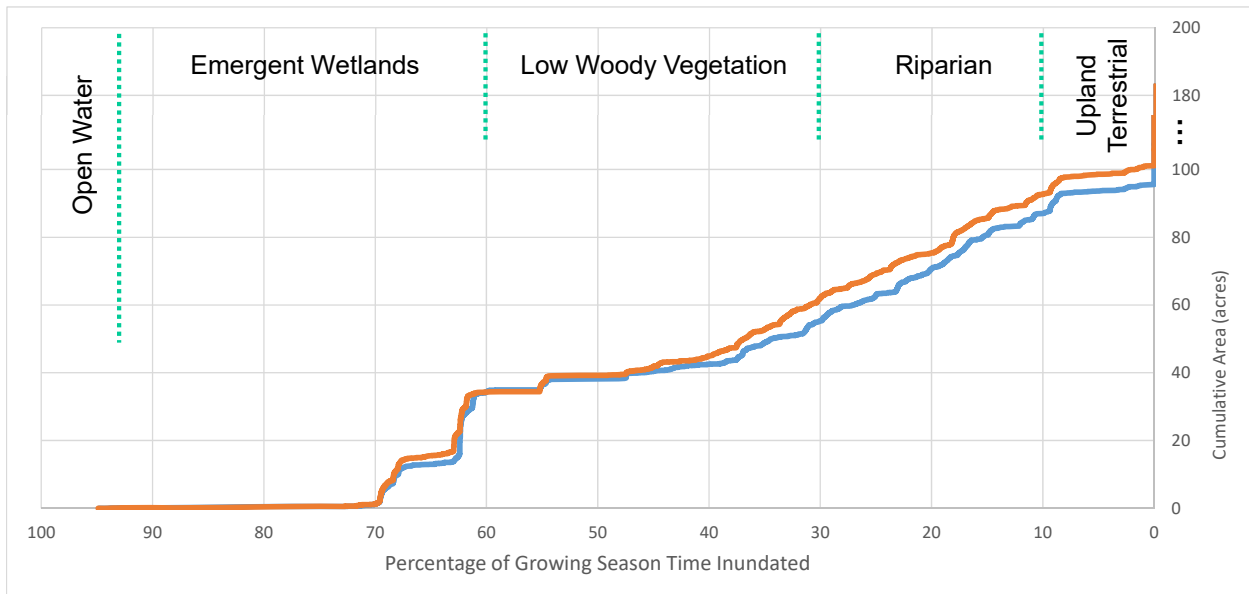
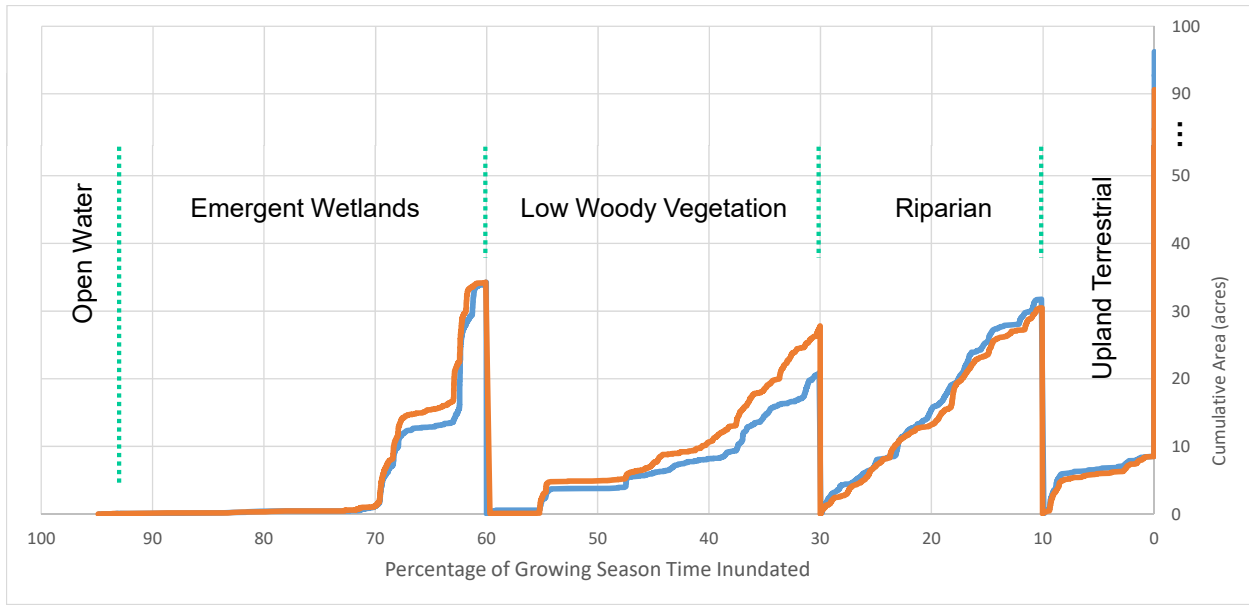
Waterfowl predators (hawks and falcons) roost and nest in upland habitats. Based on the habitat responses detailed above, how will the restoration affect waterfowl within the West Rook area?

Really no change to the area of emergent wetlands so the amount of preferred habitat available for waterfowl stayed the same. The reduction in upland terrestrial area may depress predators, but it was only a -6% shift so there is still habitat for hawks and falcons in the West Rook area. Overall, not much change, perhaps a small net positive for waterfowl.

4) Describe the overall trend in habitat change from Existing to Restored.

Putting more water into the restoration area favors the more frequently inundated vegetative communities. Interestingly, there is not enough additional water to shift areas to open water or emergent wetlands. Instead, there is a ~30% increase in Low Woody Shrub via lands transitioning from Riparian and Upland Terrestrial. The shift in Open Water area is small, but odd. The most likely explanation is that some of the open water areas were affected by topographic changes made during creation of the alternative.

Open water (>93) did not change much. Area that was emergent (93-60) got wetter, but there was very little "shrub almost emergent" existing area (see low area vales for existing in the 55-60% inundation range). What was "shrub almost emergent" shifted to emergent, but it wasn't much. Conversely, there was quite a bit of "riparian almost shrub" and "upland almost riparian". These areas shifted towards wet somewhat equally with shrub being the big winner, upland being the big loser, and riparian gaining what it lost.



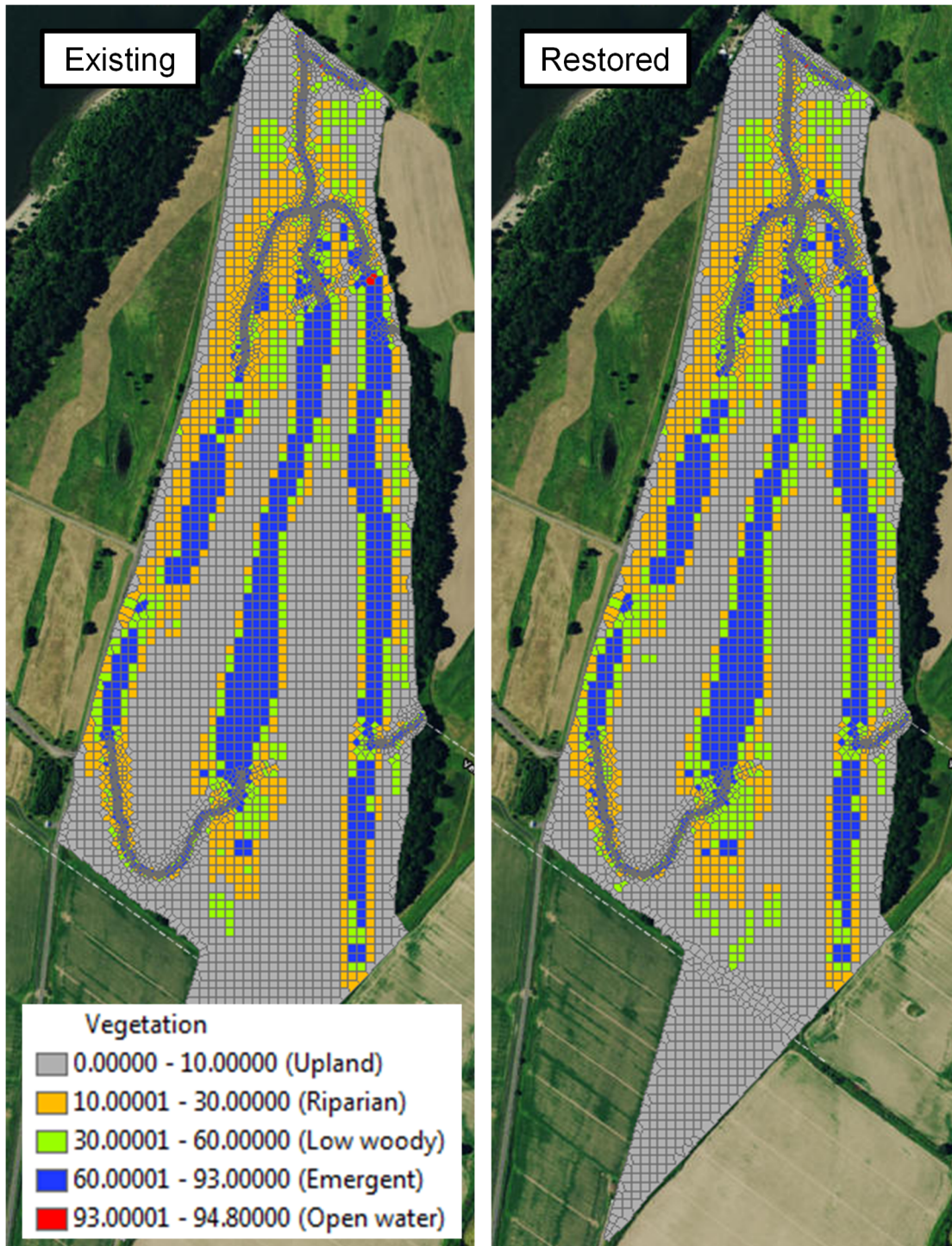
Suitable habitat area provided for salmon rearing.

Habitat Type	Existing (acres)	Restored (acres)	Change (acres)	Percent Change
Salmon Rearing	2870.7	2966.7	95.9	3%

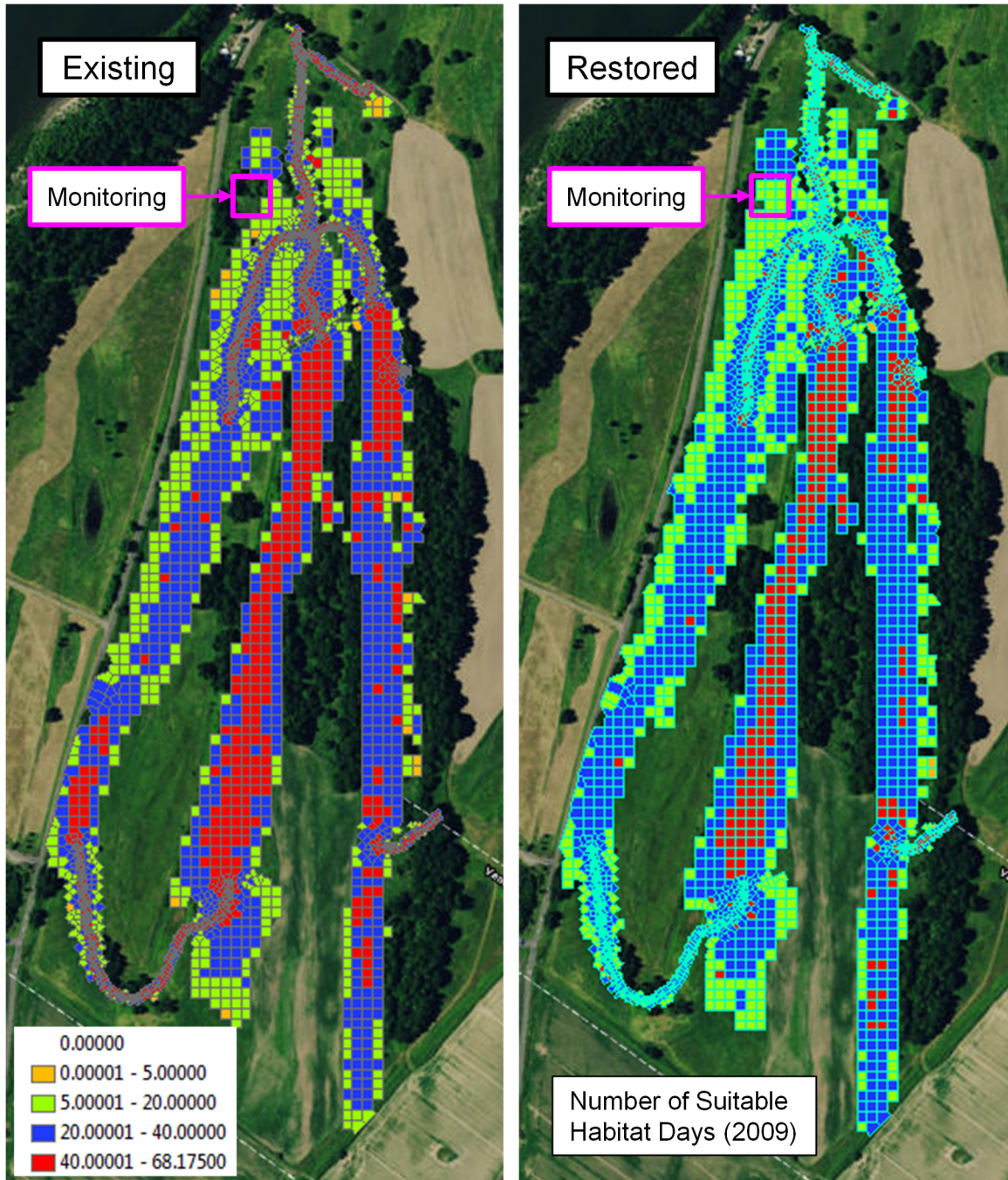
5) In West Rook, would the restored alternative generate more salmon rearing habitat?

Yes, the increased connectivity in the Restored flow regime generated 95.9 additional acres of suitable salmon rearing habitat in the 2009 season. This is a 3% increase in comparison with Existing.

Analyzing EFM Results in GIS



- 1) The Vegetation shows a slight general shift towards the wetter communities. Low woody shrub (orange) has the most visually noticeable gains, which concurs with the spreadsheet analysis. Open water (red) lost area in the northeastern portion of West Rook.



- 2) Salmon habitat extent increased slightly in the Restored alternative. There is also a positive shift on the edges of the southern regions where areas become more frequently suitable. Conversely, there are areas, such as the left and middle fork that lost suitable habitat days. This may be caused by connectivity adding waters that increase depths beyond the most suitable ranges. Gains and losses counteract leading to a net +3%, as computed in the spreadsheet analysis.
- 3) The northwestern part of West Rock is a promising area for monitoring. It is predicted to transition from Upland to Riparian, with nearby areas transitioning from Riparian to Low woody shrub. It also includes areas of new salmon extent, which could be verified through field study.

**Ecovalue Summations**

15) Pretty close. Suitable habitats provided for both flow regimes were roughly 100 acres less in the summations than in the spreadsheet. Where the spreadsheet approach predicted 3% more suitable habitat for the Restored flow regime, the summation approach predicted a 4% increase.

Suitable habitat area provided for salmon rearing via the summation approach.

**Ecovalue Summations**

	Salmon Summation
<b>Flow Regime</b>	<b>Ecovalue, total</b>
WR_Existing	2,773.5
WR_Restored	2,883.6

Suitable habitat area provided for salmon rearing via the spreadsheet approach.

<i>Habitat Type</i>	Existing (acres)	Restored (acres)	Change (acres)	Percent Change
Salmon Rearing	2870.7	2966.7	95.9	3%

16) There are several steps. Starting with the whole flow regime, EFM considers stages in the salmon season, translates stages to suitabilities (0 to 1) based on the HSI in the hypothesis ecovalue curve, and suitabilities are translated to suitable areas based on element areas in the paired data tables. This is done for each day in the season and each day is accumulated to get the final tally for the whole period of record. It's a lot, but powerful...full tally of salmon rearing habitat for the period of record.

17) They're different because the ecovalue summations portion of the workshop used the whole HSI. The spreadsheet portion used the discretized or binned HSI that applied suitabilities to a range of stages. The ecovalue summations approach is more explicit and direct.