Coquille River watershed stream flow projections

Based on variable infiltration capacity (VIC) model

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Introduction and Purpose

- Flow regime is of fundamental importance in determining the physical and ecological characteristics of a river or stream, but actual measurements are in short supply.
- This data is intended to help fill that role by:
    1. Having broad coverage
    2. Showing patterns across a watershed
    3. Accounting for historic and future hydrologic regimes

Input

- National Hydrography Dataset (NHD+) for Columbia basin and coastal drainages
- A1B emissions scenarios for 2040 and 2080
- 10 global climate models (GCMs)
- Two additional temperature models

Strengths and limitations

- Works for Coquille sub-basin scale
- Relatively conservative methodology
- Authors acknowledge limitations
- Widely used and trusted

- This version does not incorporate groundwater inputs
- Addresses Winter and Summer, but not Spring and Fall
- Deals with supply/yield, but not sedimentation or water quality

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Based on variable infiltration capacity (VIC) macroscale hydrologic model, as modeled by the Western U.S. Stream Flow Metric Dataset (Wenger et al., 2010).

www.fs.fed.us/rm/boise/AWAE/projects/modeled_stream_flow_metrics.shtml

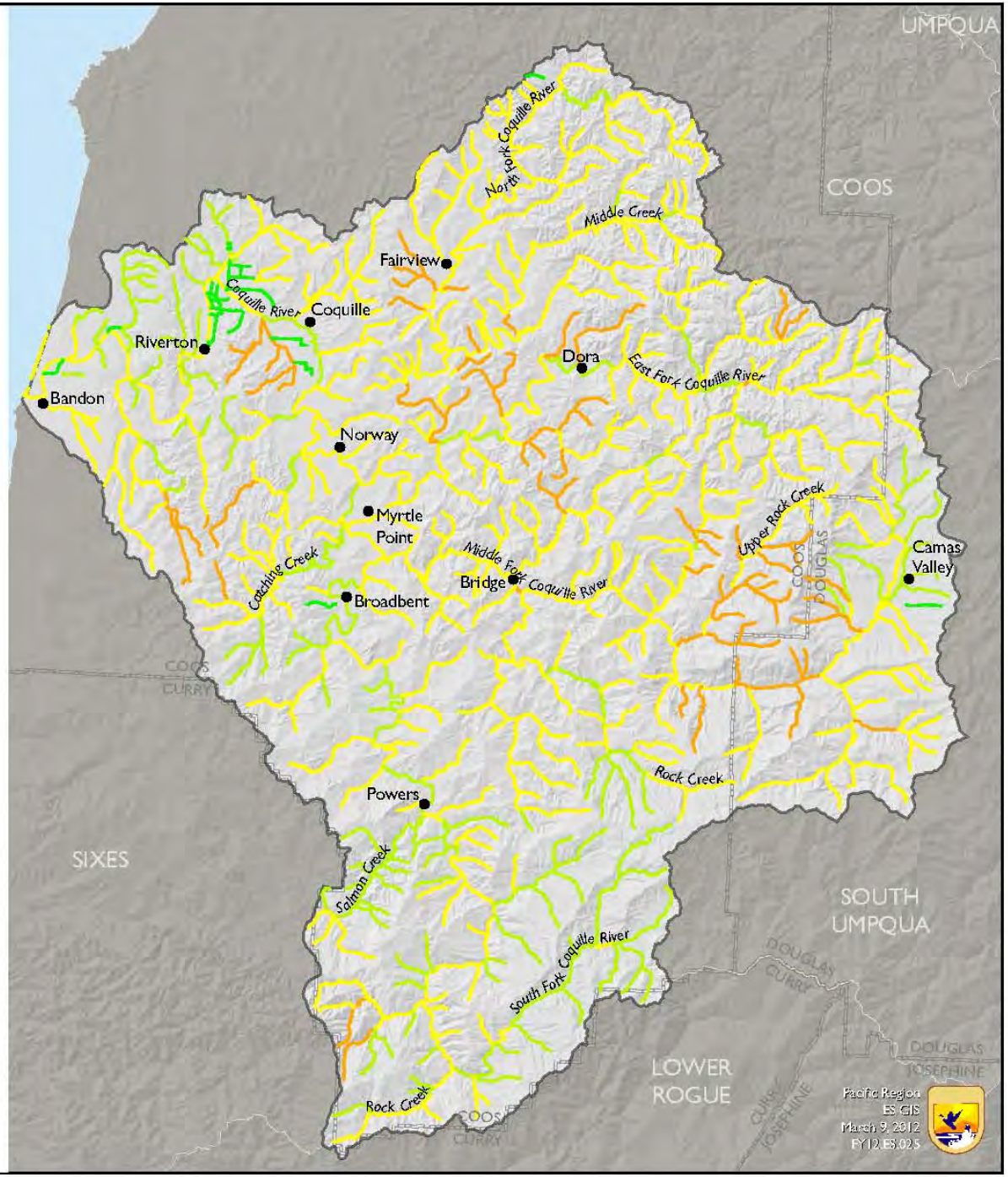
Date of Center of Flow Mass (CFM): Historic* to 2040

- No change
- 1 to 2 days earlier
- 3 days earlier
- 4 days earlier

***Historic period of reference is 1978-1997.**

0 5 10
Miles

N



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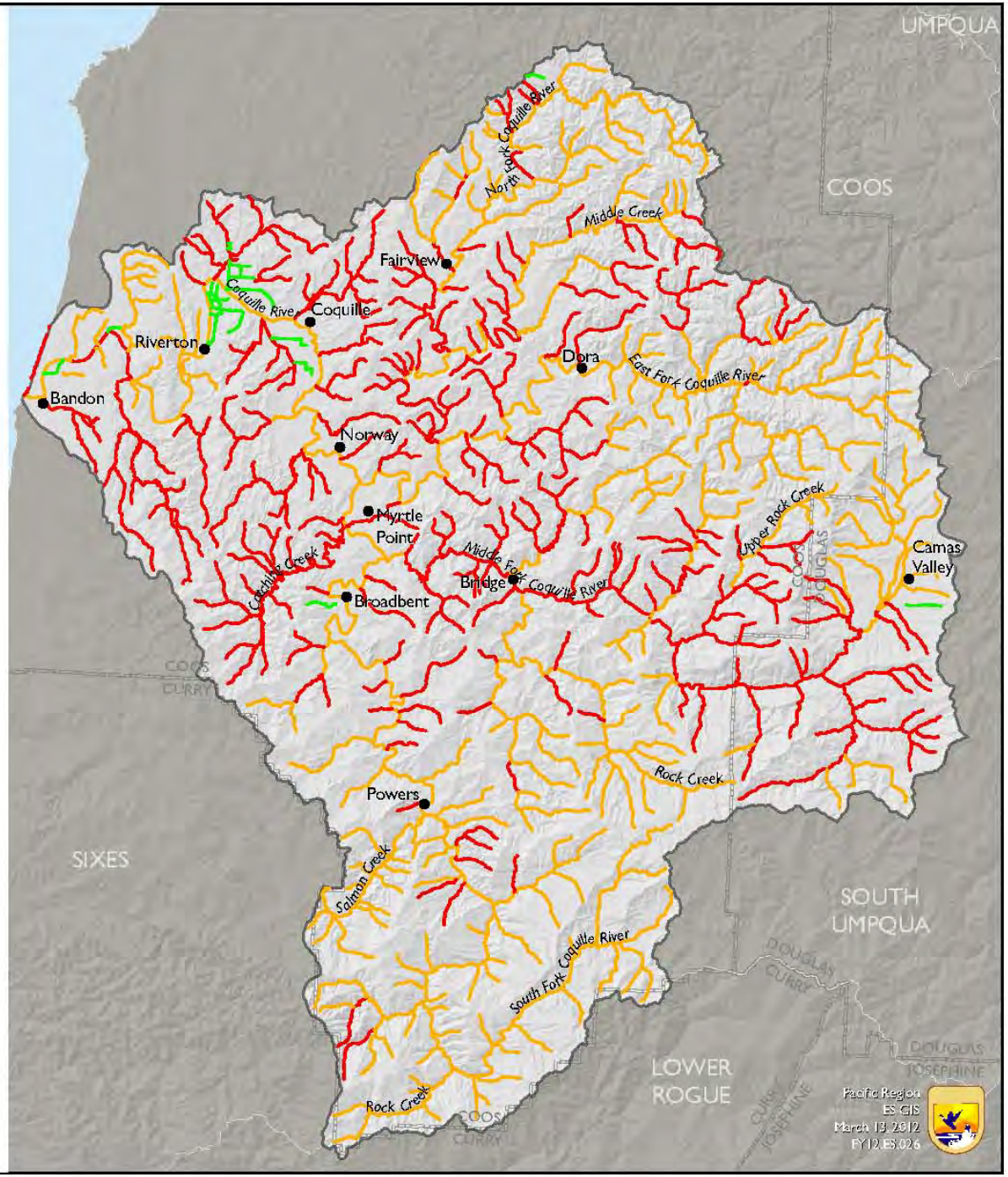
Date of Center of Flow Mass (CFM): Historic* to 2080

- No change
- 1 to 3 days earlier
- 4 to 6 days earlier
- 7 to 9 days earlier

***Historic period of reference is 1978-1997.**

0 5 10
Miles

N



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Mean daily flow change: Historic* to 2040

- -4.25 to -5.56 %
- -2.5 to -4.25 %
- -1.25 to -2.50 %
- 0 to -1.25 %
- +0.01 to +1.7%

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Mean daily flow change: Historic* to 2080

- -5.50 to -6.78 %
- -4.25 to -5.50 %
- -2.50 to -4.25 %
- -1.25 to -2.50 %
- 0 to -1.25 %

*** Historic period of reference is 1978-1997.**

0 5 10
Miles

N

UMPQUA
COOS
SIXES
SOUTH UMPQUA
LOWER ROGUE
CURRY
DOUGLAS
JOSEPHINE
North Fork Coquille River
Middle Creek
Fairview
Coquille River
Coquille
Riverton
Bandon
Dora
East Fork Coquille River
Norway
Myrtle Point
Catching Creek
Middle Fork Coquille River
Bridge
Broadbent
Upper Rock Creek
Camas Valley
Rock Creek
Powers
Salmon Creek
South Fork Coquille River
Rock Creek

Pacific Region
ES GIS
March 9, 2012
FY12.ES.028

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Mean summer flow change: Historic* to 2040

- -15 to -17.07 %
- -13 to -15 %
- -11 to -13 %
- -9 to -11 %
- -5 to -9 %

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0 5 10
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N

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Mean summer flow change: Historic* to 2080

- -21.00 to - 24.39 %
- -19 to -21 %
- -16 to -19 %
- -13 to -16 %
- -7 to -13 %

*** Historic period of reference is 1978-1997.**

0 5 10
Miles

N

UMPQUA
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Norway
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Camas Valley
Powers
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Middle Creek
Coquille River
East Fork Coquille River
Upper Rock Creek
Middle Fork Coquille River
Cedarville Creek
Rock Creek
Salmon Creek
South Fork Coquille River
Rock Creek

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Probability of a 2-year flow event in Winter (0 to 100 percent)

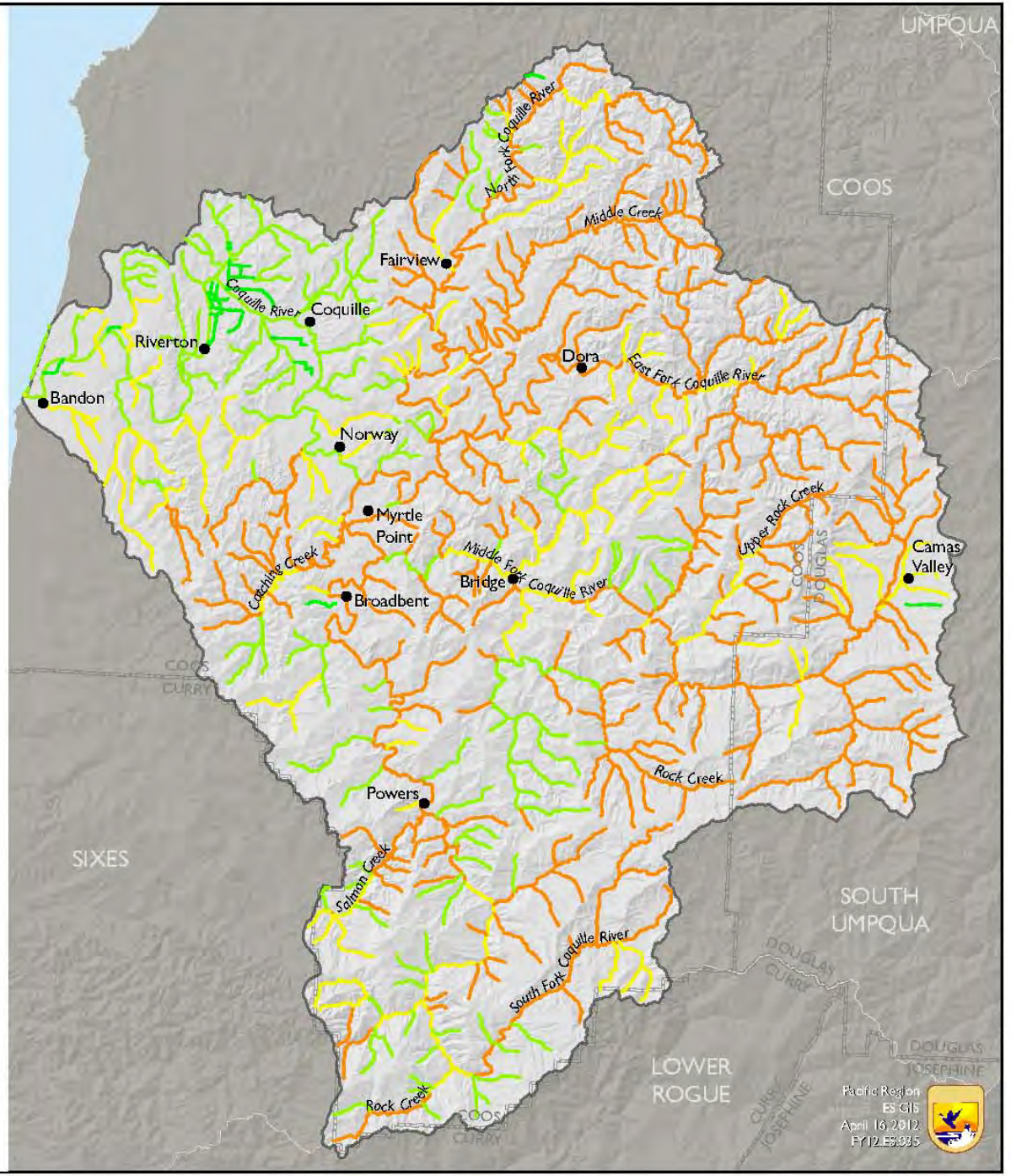
Historic*

- 0 percent
- 1 to 20 percent
- 20 to 25 percent
- 25 to 30 percent

*** Historic period of reference is 1978-1997.**

0 5 10
Miles

N



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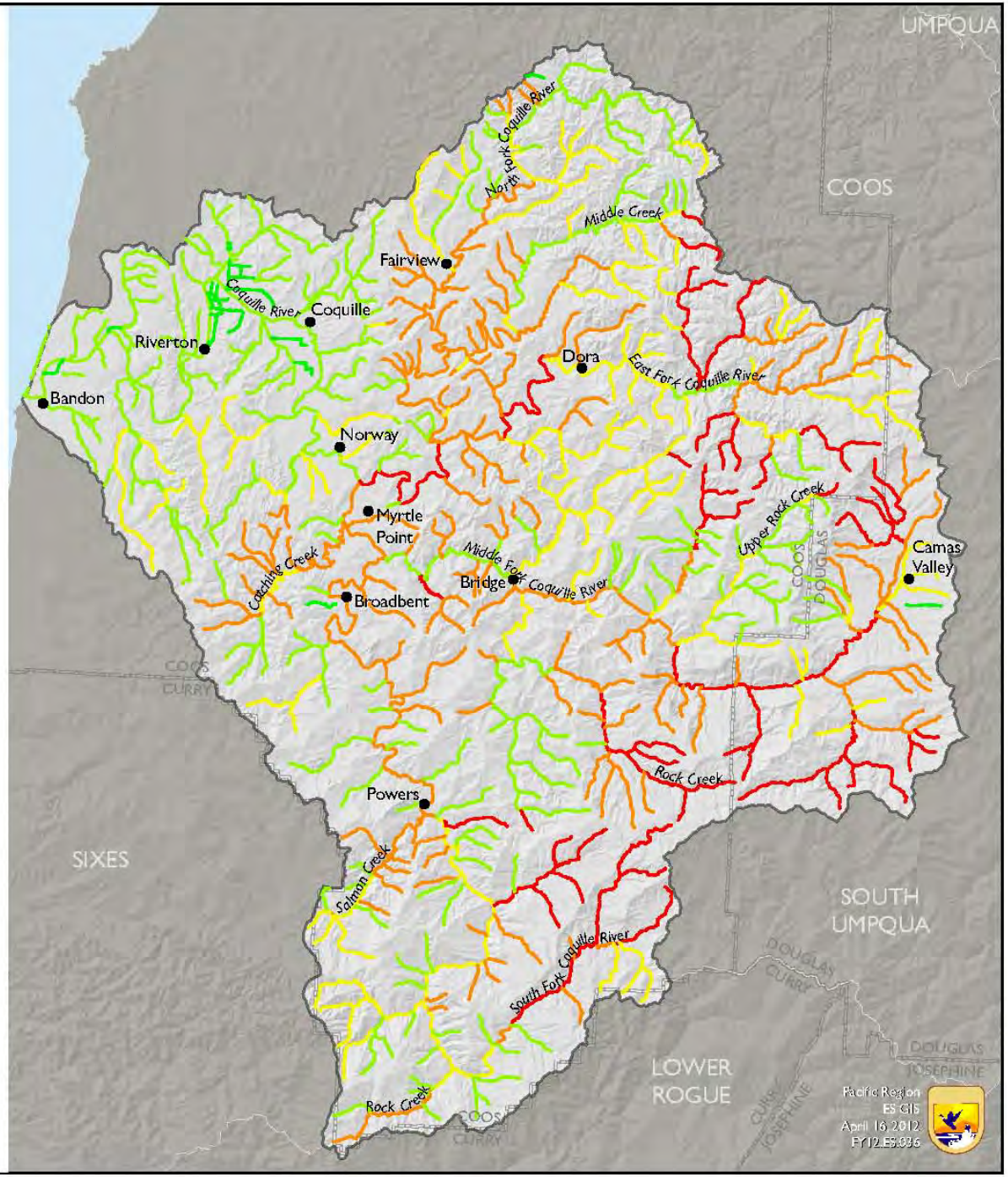
Probability of a 2-year flow event in Winter (0 to 100 percent)

2040 projection

- 0 percent
- 1 to 20 percent
- 20 to 25 percent
- 25 to 30 percent
- 30 to 35 percent

0 5 10
Miles

N



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Probability of a 2-year flow event in Winter (0 to 100 percent)

2080 projection

- 0 percent
- 1 to 20 percent
- 20 to 25 percent
- 25 to 30 percent
- 30 to 40 percent

0 5 10
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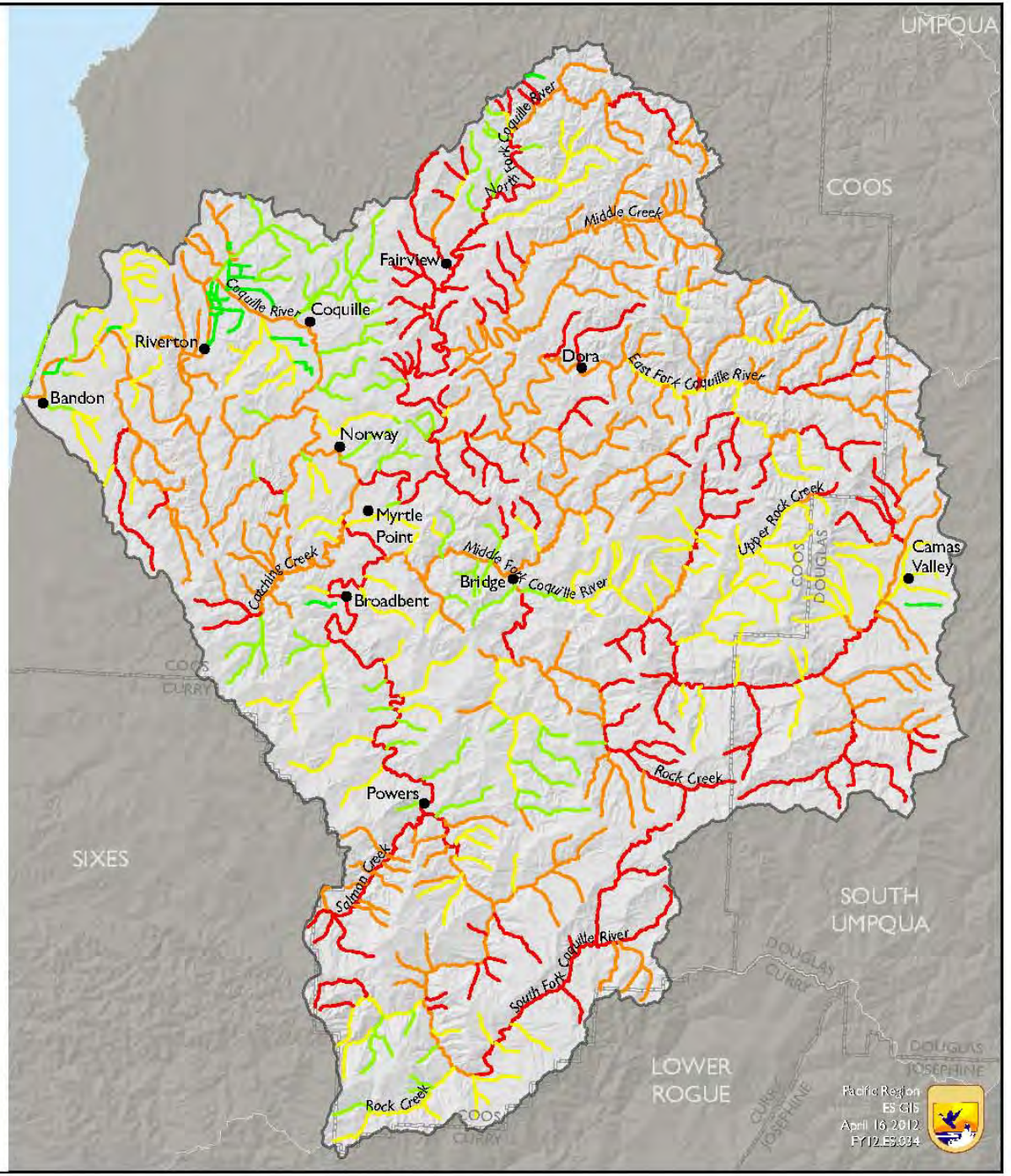
N



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Winter days in which flows are in the highest 5% for year

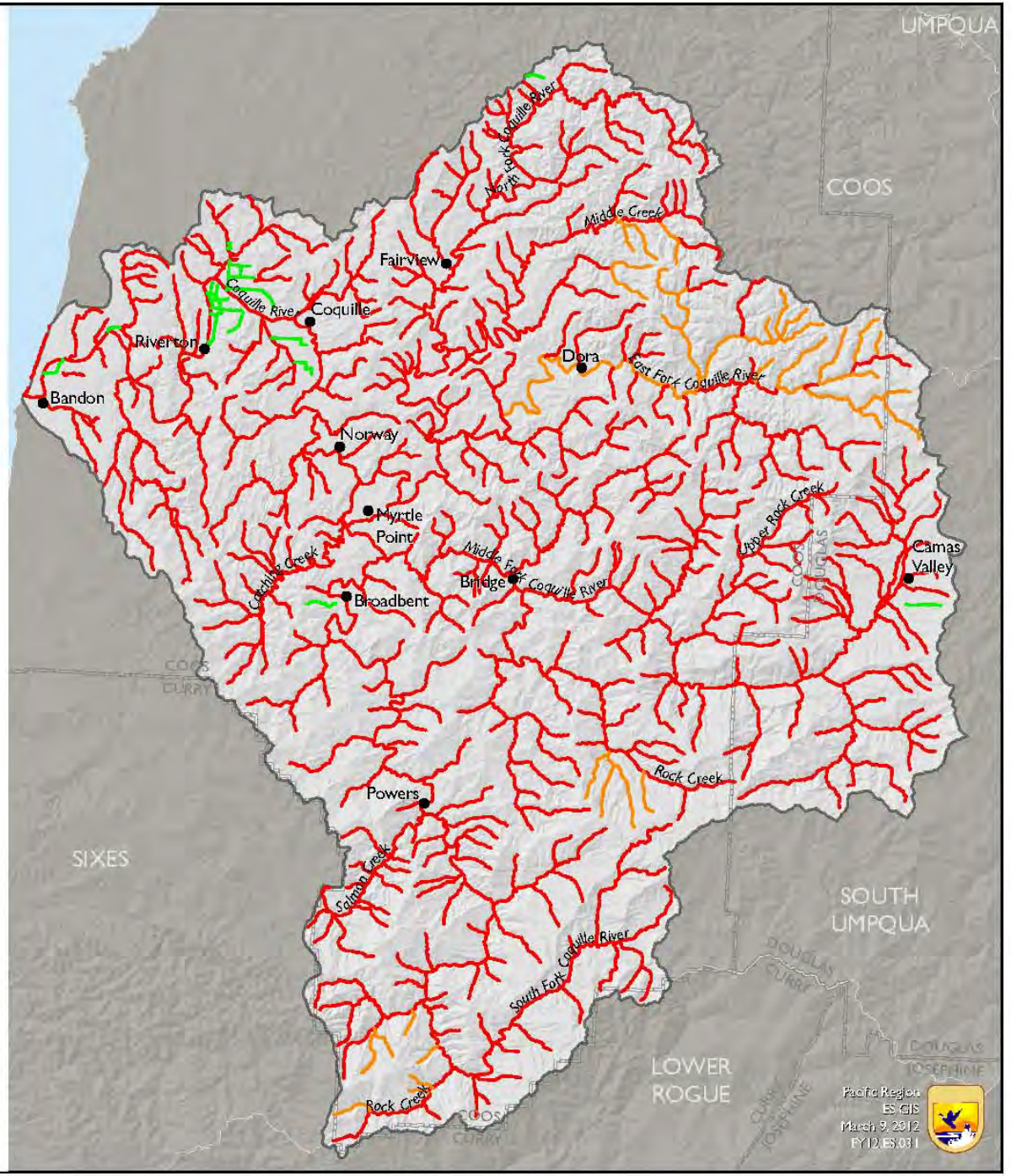
Historic*

- 0.00 to 0.50
- 0.51 to 3.00
- 3.01 to 6.00
- 6.01 to 12.00
- 12.01 to 17.10

*** Historic period of reference is 1978-1997.**

0 5 10
Miles

N



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- 12.01 to 17.50

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Pacific Region
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Winter days in which flows are in the highest 5% for year

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- 0.51 to 3.00
- 3.01 to 6.00
- 6.01 to 12.00
- 12.01 to 17.90

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March 9, 2012
FY12.ES.030

Potential ecological implications

- Shift to an earlier midpoint of water year, but not the magnitude seen in other watersheds within the region.
- Greater reduction in freshwater refugia and other aquatic resources in summer.
- Greatest projected change in mean daily flow is in lower watershed, an important anadromous fish rearing environment.
- Flashier conditions in Spring and late Fall?

Other metrics and capabilities

- The data set also can show changes in:
  - 7-day low flow with a 10-year return interval (cfs)
  - Channel-forming flow (cfs)

Related publications

- Wenger *et al*. 2010. Macroscale hydrologic modeling of ecologically relevant flow metrics. *Water Resources Research* 46: W09513.
- Wenger *et al*. 2011. Flow regime, temperature, and biotic interactions drive different declines of trout species under climate change. *Proceedings of the National Academy of Science* 108 (34):14175-14180.
- Vigerstol & Aukema. 2011. A comparison of tools for modeling freshwater ecoystem services. *Journal of Environmental Management* 92: 2403-2409.

Other resources

- Steele *et al*. 2011. Potential Climate-Induced Runoff Changes and Associated Uncertainty in Five Pacific Northwest Estuaries.
- GSFLOW
- SWAT

Questions or comments?

Mixed flock of Least and Western Sandpipers at Bandon Marsh NWR

Credit: David Ledig , USFWS Region 1