IDAHO DEPARTMENT OF
WATER RESOURCES

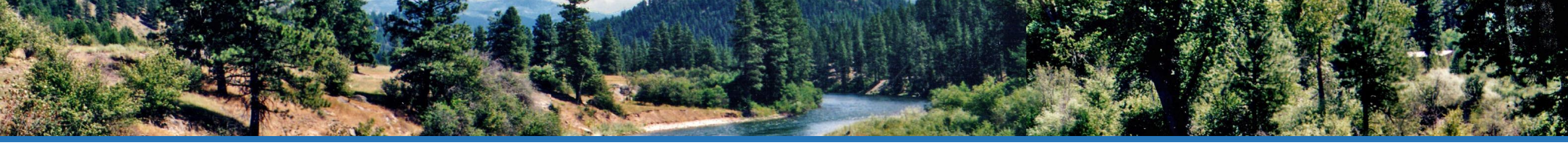
Methods of Irrigation Classification for the Treasure Valley

Presented by Mason Bull
Date 3/10/2026

IDAHO DEPARTMENT OF WATER RESOURCES

Irrigation is a critical measurement in the Treasure Valley

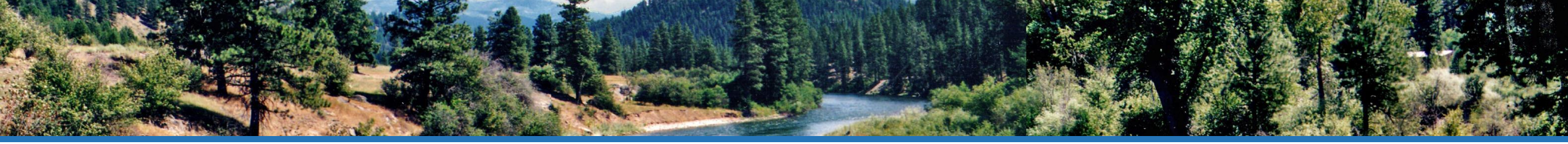
- How we calculate irrigated area is important
- We used to use hand-digitization
- We are going to discuss how we should classify irrigation moving forward



Landcover in the Treasure Valley is difficult to Classify

- The mix of agriculture irrigation and cities poses unique issues
- Irrigation is a major factor in groundwater modelling, and thus needs to be accurate and timely

IDAHO DEPARTMENT OF WATER RESOURCES



IDWR Produces Irrigation Maps in-house

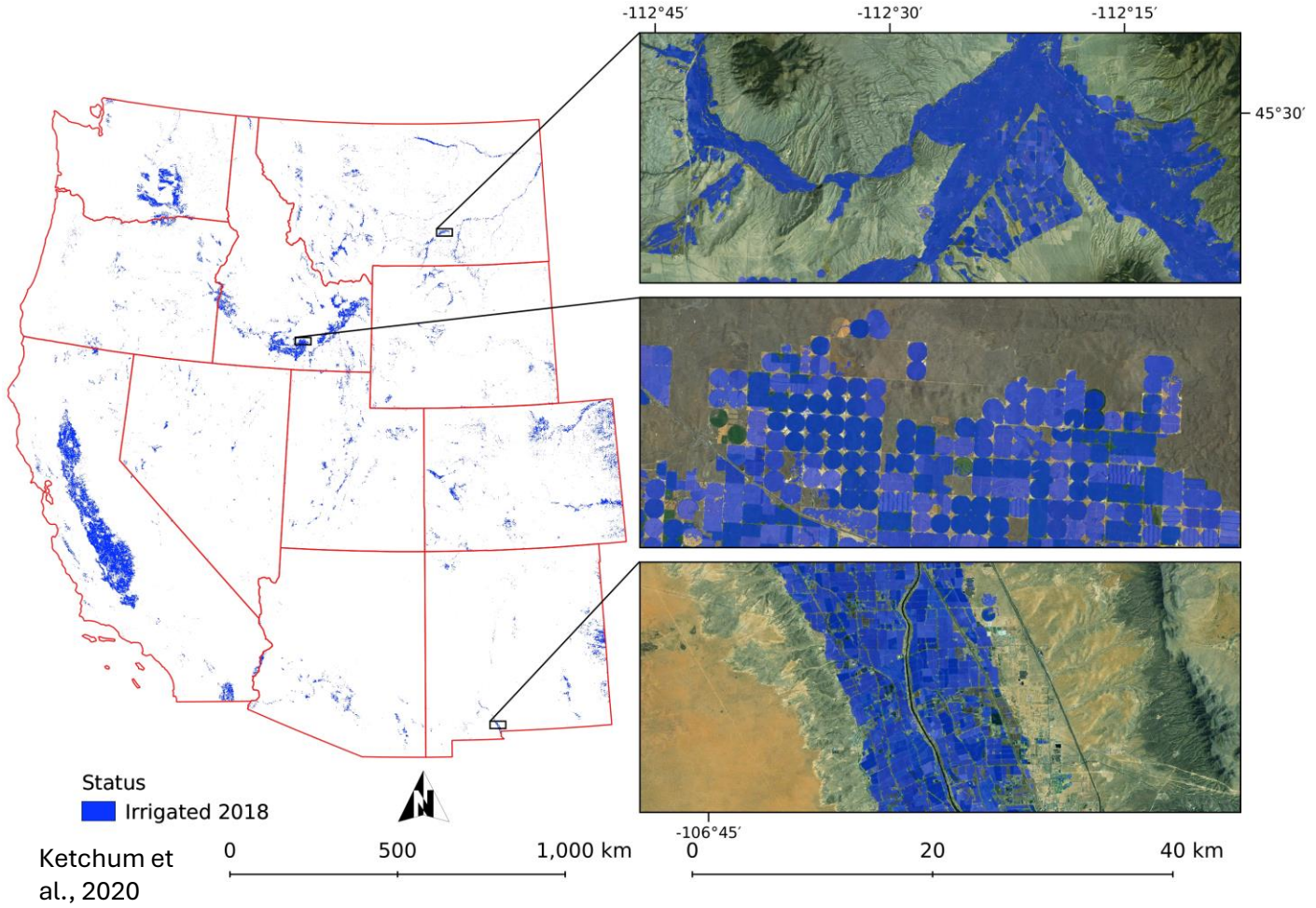
- We create our own model to classify irrigation
  - Classified via Random Forest (RF)
  - Training data created by IDWR employees
  - Previously we created hand-digitized models
- There are other, out-of-the-box models classifying irrigation
  - IrrMapper
  - NLCD

```python
# time_range is the start and end of the imagery search
time_range = (
    datetime(input_params["year"], *input_params["start"]),
    datetime(input_params["year"], *input_params["end"]),
)
tag = (
    input_params["area"].lower().replace(" ", "").replace("_", "-")
    + "-"
    + str(input_params["year"])
    + "-"
    + report_no.lower()
)

# output files
results_version = tag + "-classification"
probability_version = tag + "-probability"

# gee credentials
ee.Authenticate()
ee.Initialize(project=input_params["GEE_project_ID"])
ee.data.setDefaultWorkloadTag(tag)
print("\nGEE tag: ", tag)
print("Model run: ", report_no)

# bounding box of AOI
ee_bbox = GetBbox(input_params["aoi"])

Run Cell | Run Above | Debug Cell
# %% Prepare imagery ==========
done = False
t = threading.Thread(kwargs={"message": "Averaging imagery... "}, target=animate, daemon=True)
t.start()
avg_sr_imagery, max_ndvi_imagery, sr_names = CreateAveragedImagery(ee_bbox, time_range)
done = True
sleep(0.1)

done = False
t = threading.Thread(kwargs={"message": "Compositing imagery... "}, target=animate, daemon=True)
t.start()
img_features, datasets = CompositeImagery(
    ee_bbox, time_range, avg_sr_imagery, max_ndvi_imagery, tag, sr_names, input_params['aoi']
)
done = True
sleep(0.1)


Run Cell | Run Above | Debug Cell
# %% Classification ==========
classified, probabilities = PerformClassification(
    input_params, img_features, report_dir, datasets, tag, code_vers
)


Run Cell | Run Above | Debug Cell
# %% Review ==========
if input_params['mode'] == 't':
    DisplayMap(ee_bbox, classified, input_params["aoi"], results_version, report_dir)
else:
    print('Map will only display in testing mode. Please wait for final output to view the map.')

Run Cell | Run Above | Debug Cell
# %% Export ==========

ExportClassifiedImagery(
    classified,
    probabilities,
```

IDAHO DEPARTMENT OF WATER RESOURCES

IrrMapper is a large-scale random forest

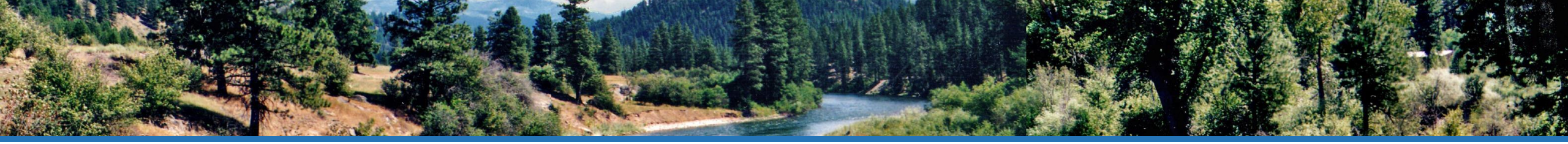
- IrrMapper is a random forest that covers the entire western US
  - Binary classification where 1 is irrigated, everything else is non-irrigated
  - 1985 - 2024



Ketchum et al., 2020

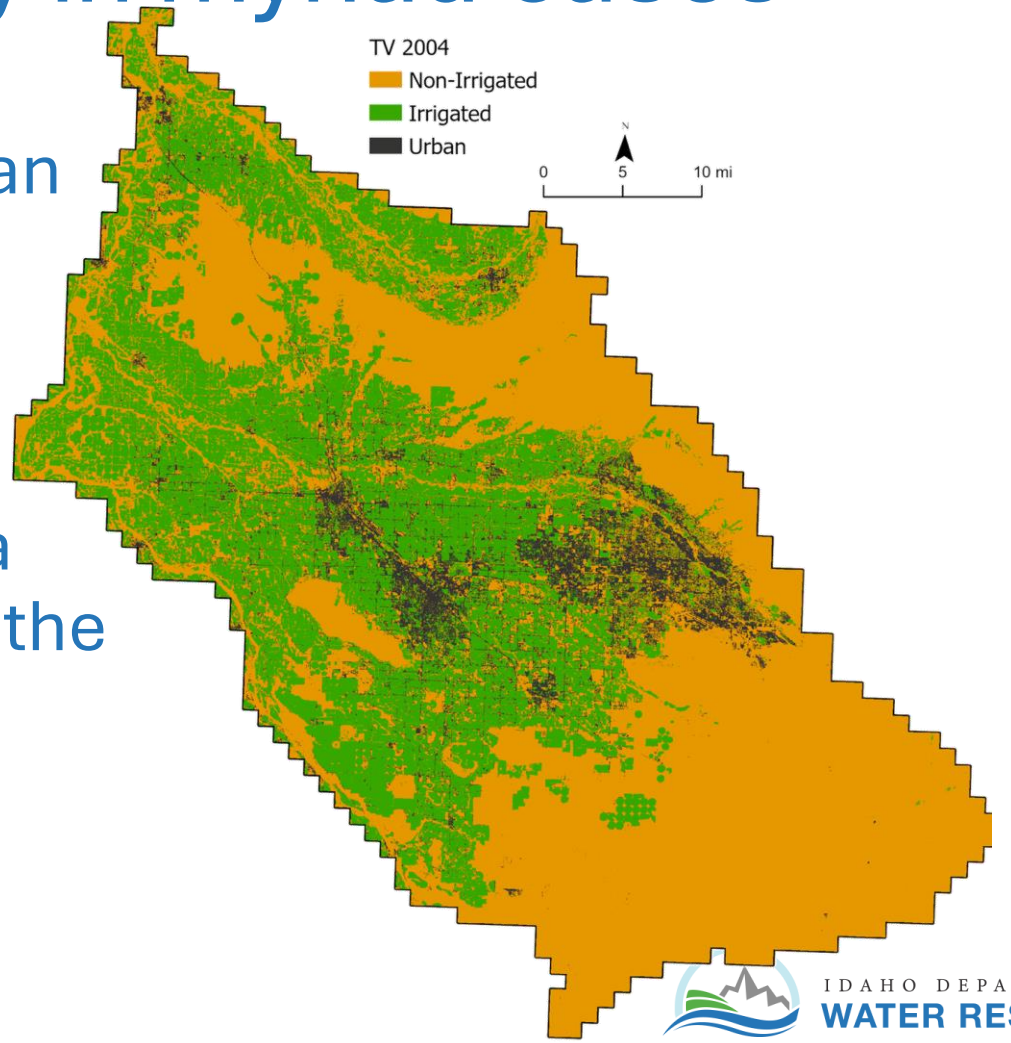
NLCD is a national scale model

- NLCD is an ensemble of Neural Nets
  - We use the Cultivated class as a proxy for irrigation
  - We use low, medium, and high intensity developed as Urban
  - 1985 - 2024

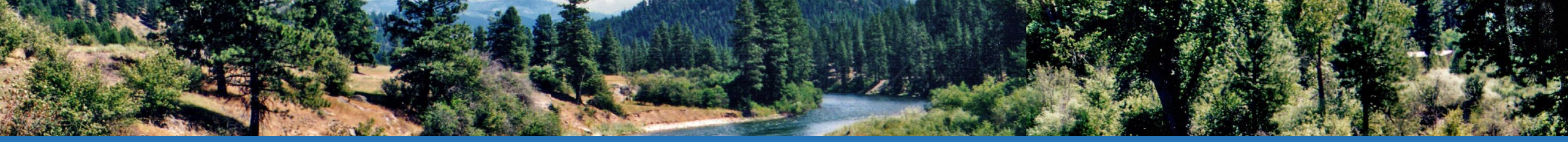


IDWRRF predicts accurately in myriad cases

- IDWRRF data predicts trends better than IrrMapper or NLCD
- Our model does not have an entire catalog of data, but is fast to create
- We have total control over training data and model inputs to tune the model to the Treasure Valley

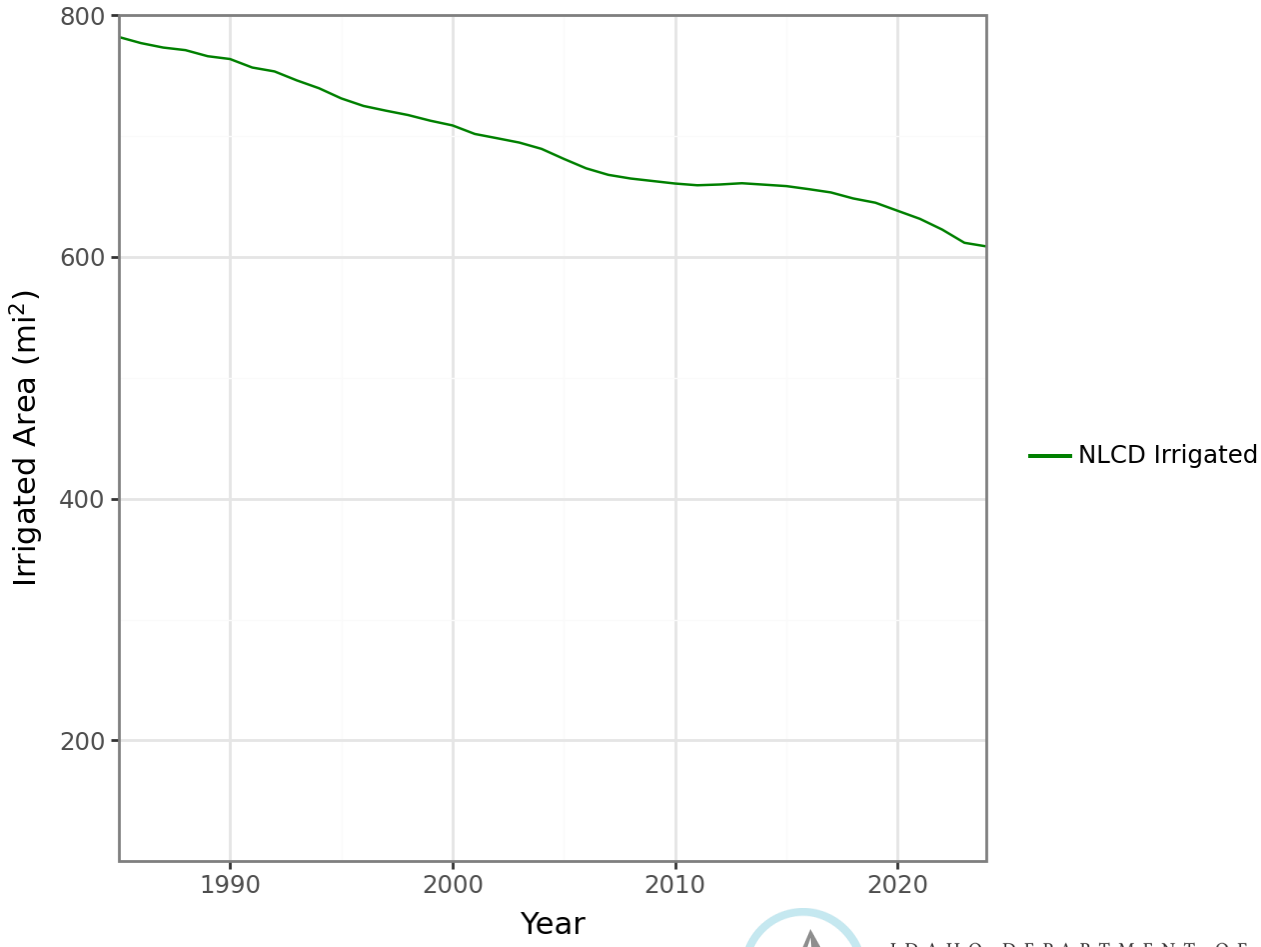


IDAHO DEPARTMENT OF WATER RESOURCES

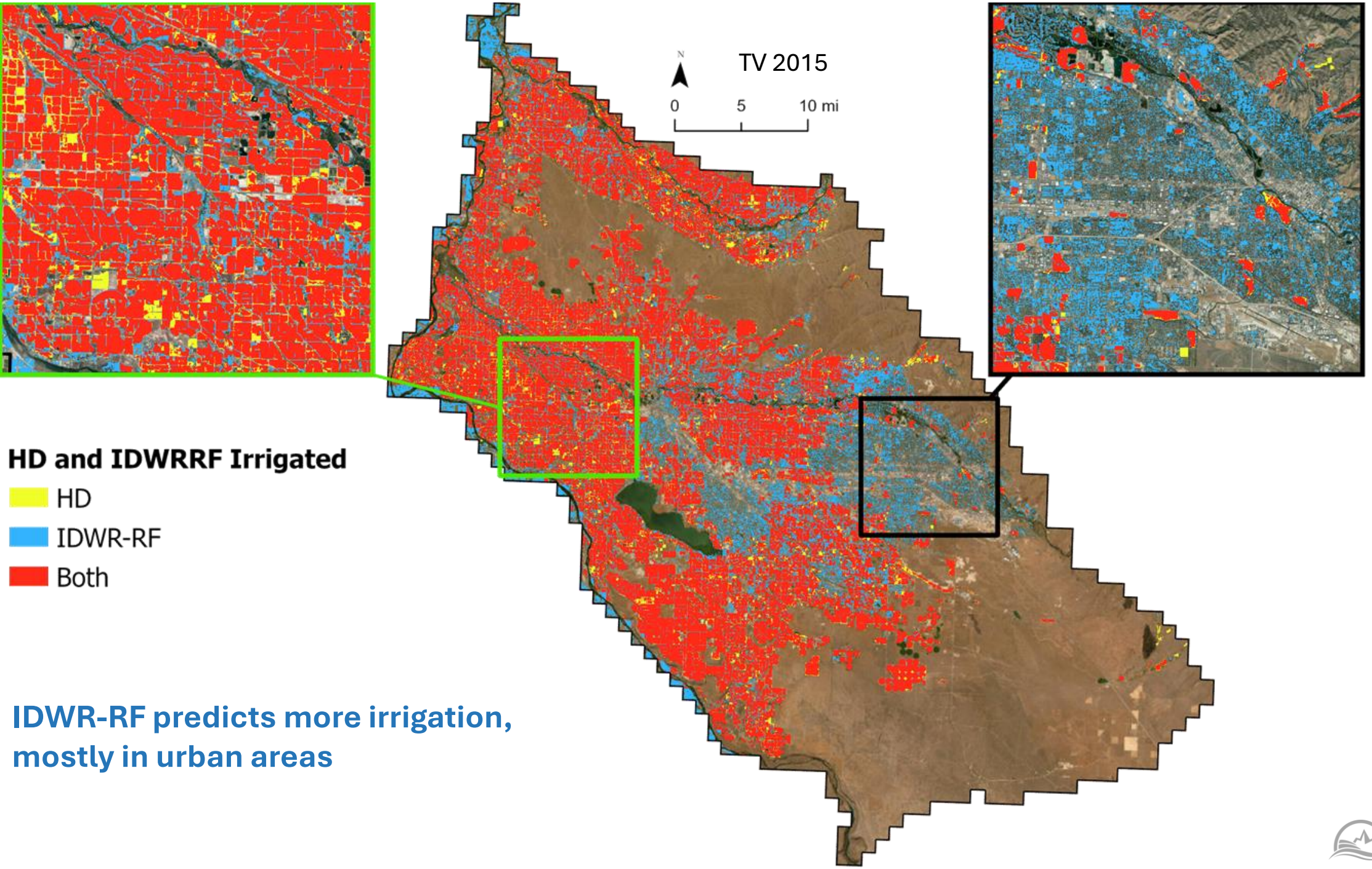


There is no ‘Goldilocks’ model

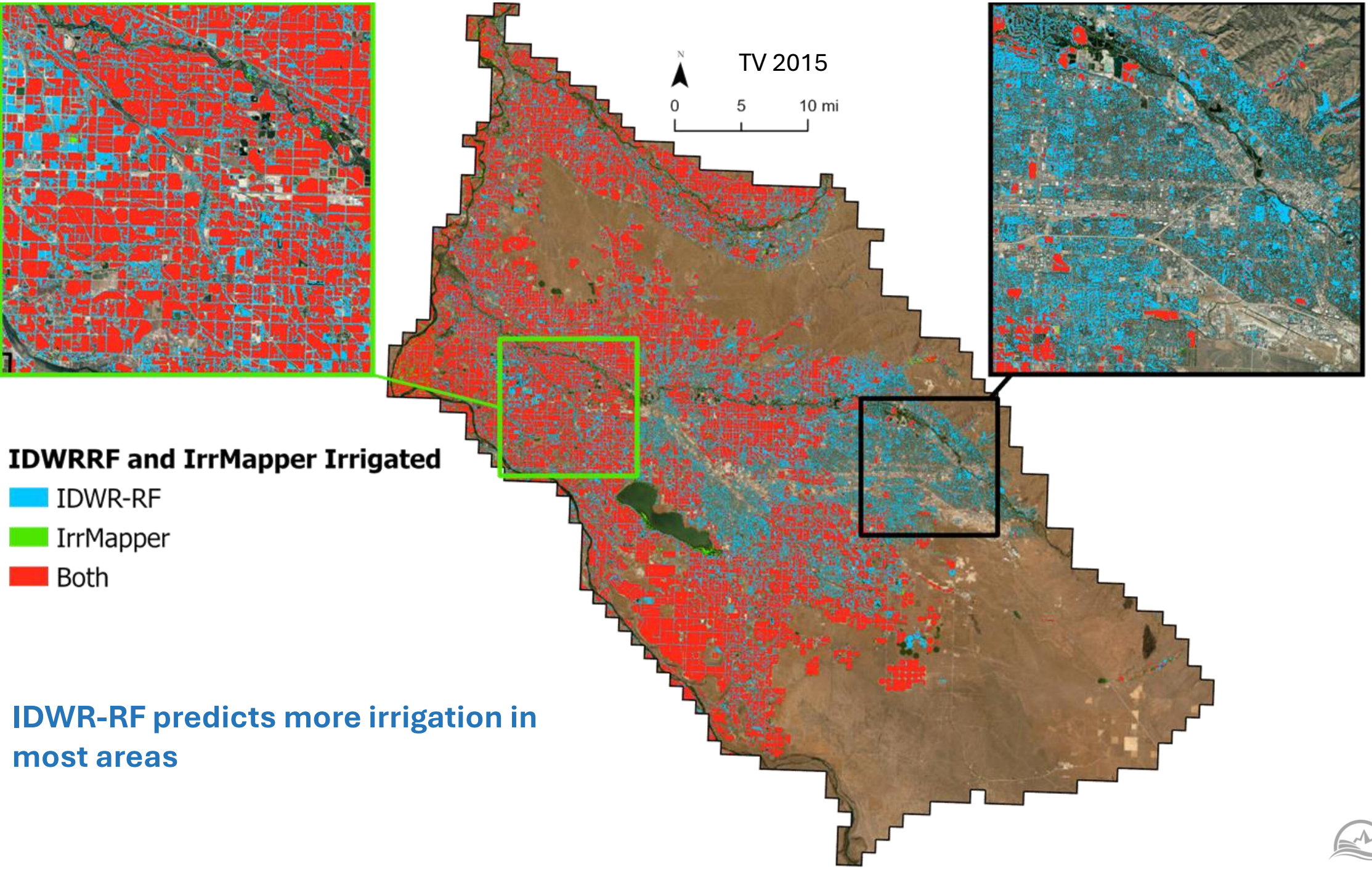
- NLCD too smooth to predict natural variance
- IrrMapper shows a lot of noise in the data
- Hand-digitized is time prohibitive
- IDWRRF ideally fits in between these models



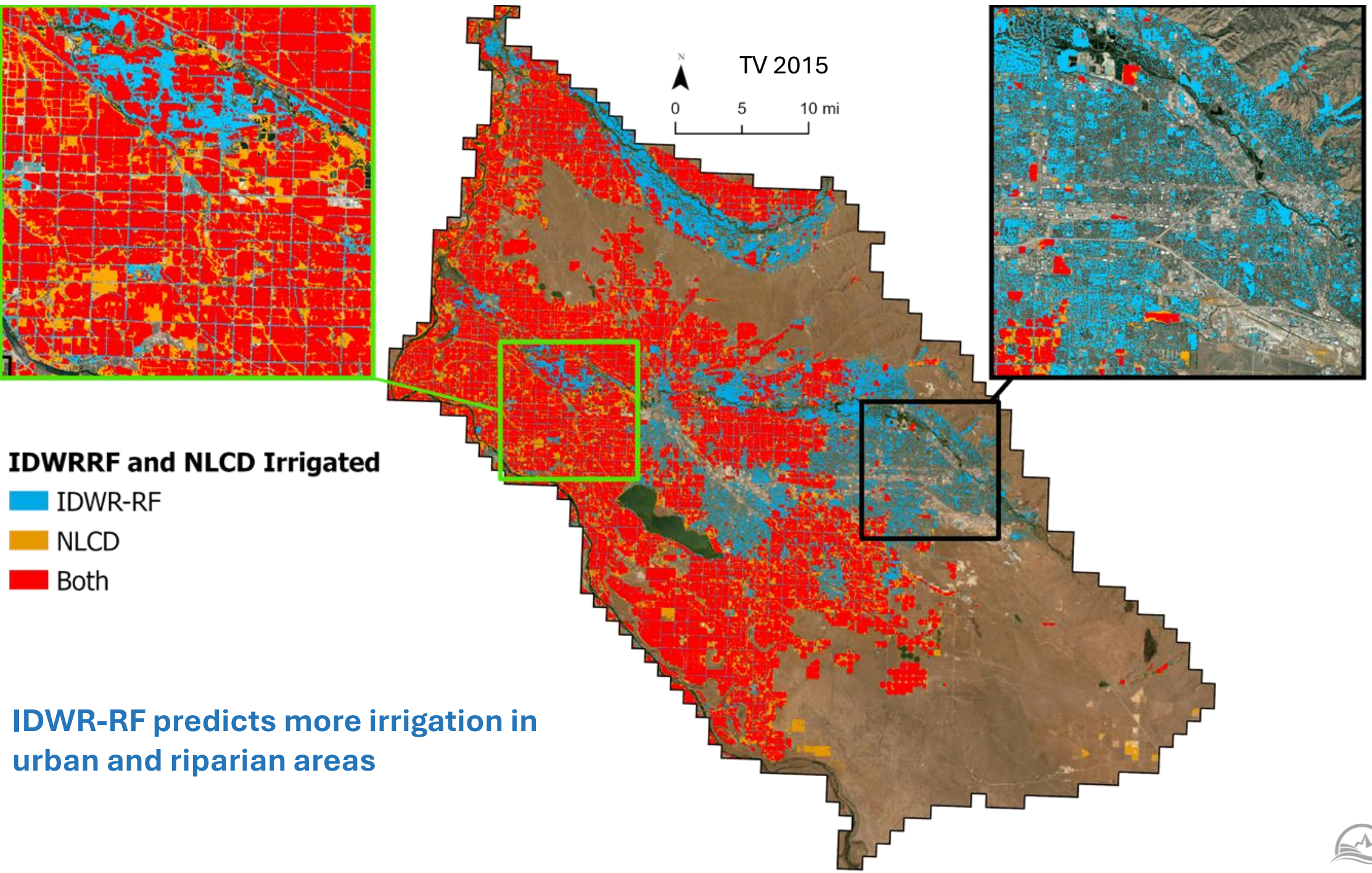
IDAHO DEPARTMENT OF WATER RESOURCES



IDWR-RF predicts more irrigation, mostly in urban areas

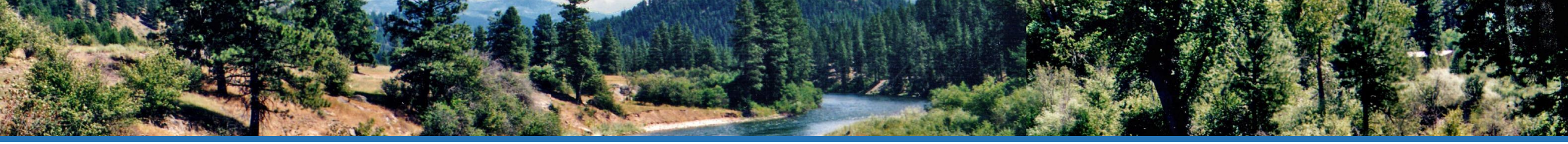


IDWR-RF predicts more irrigation in most areas



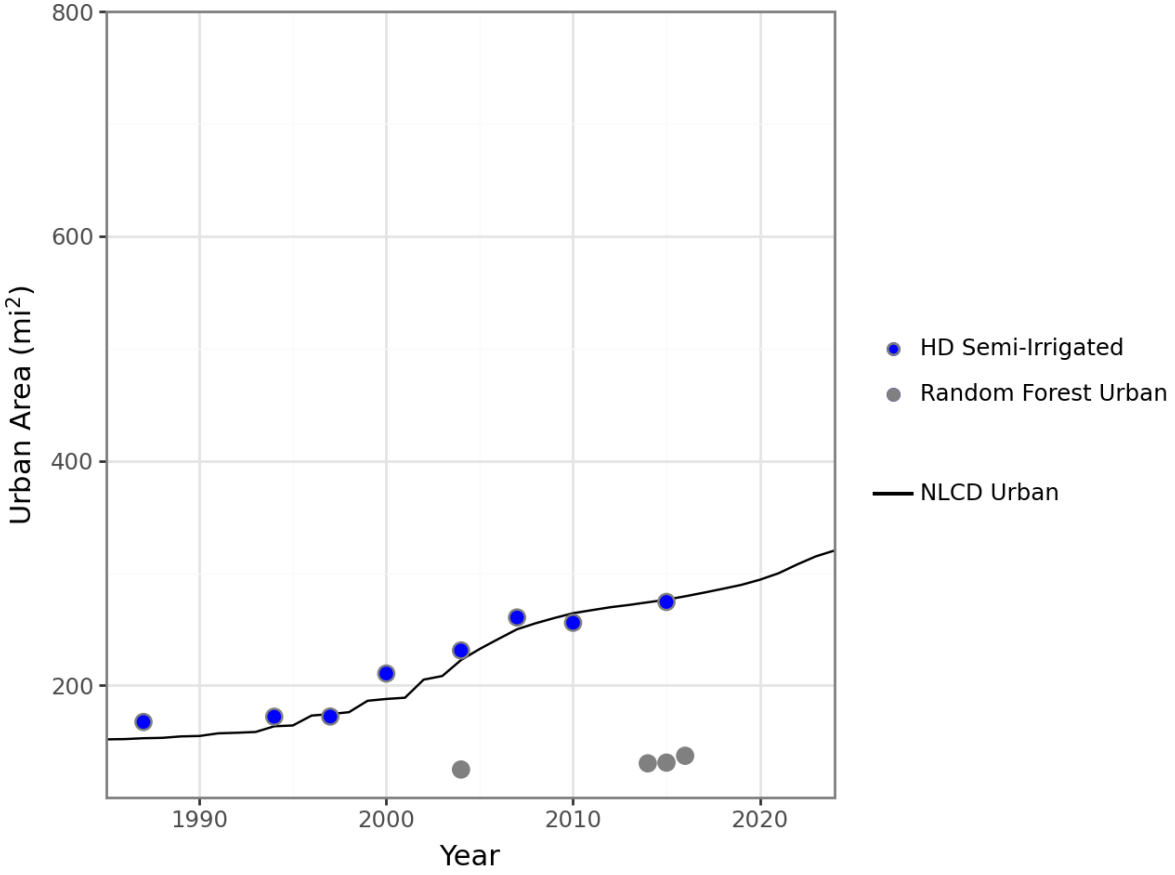
IDWR-RF predicts more irrigation in urban and riparian areas

IDAHO DEPARTMENT OF WATER RESOURCES

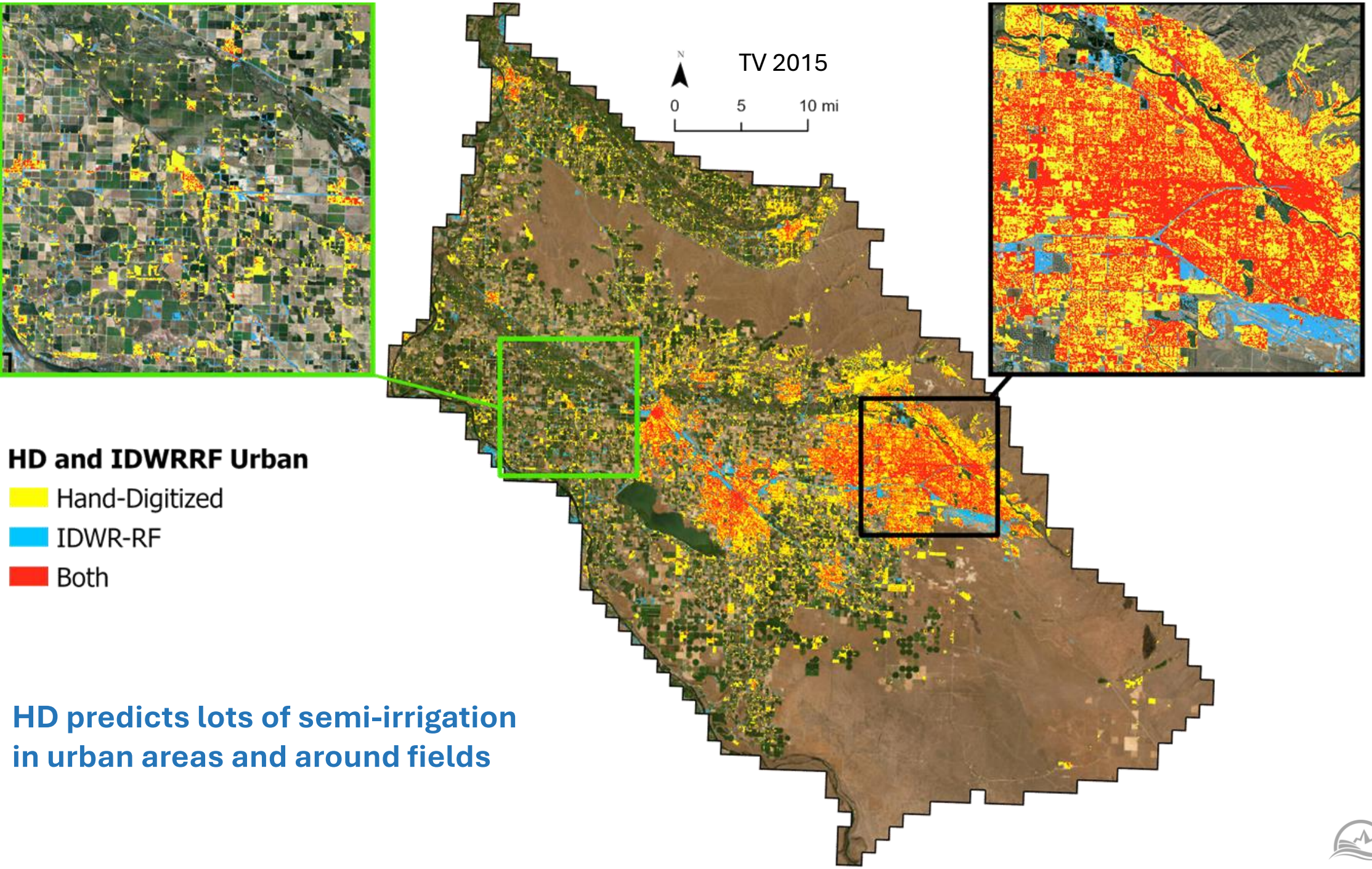


Urban area is difficult to classify

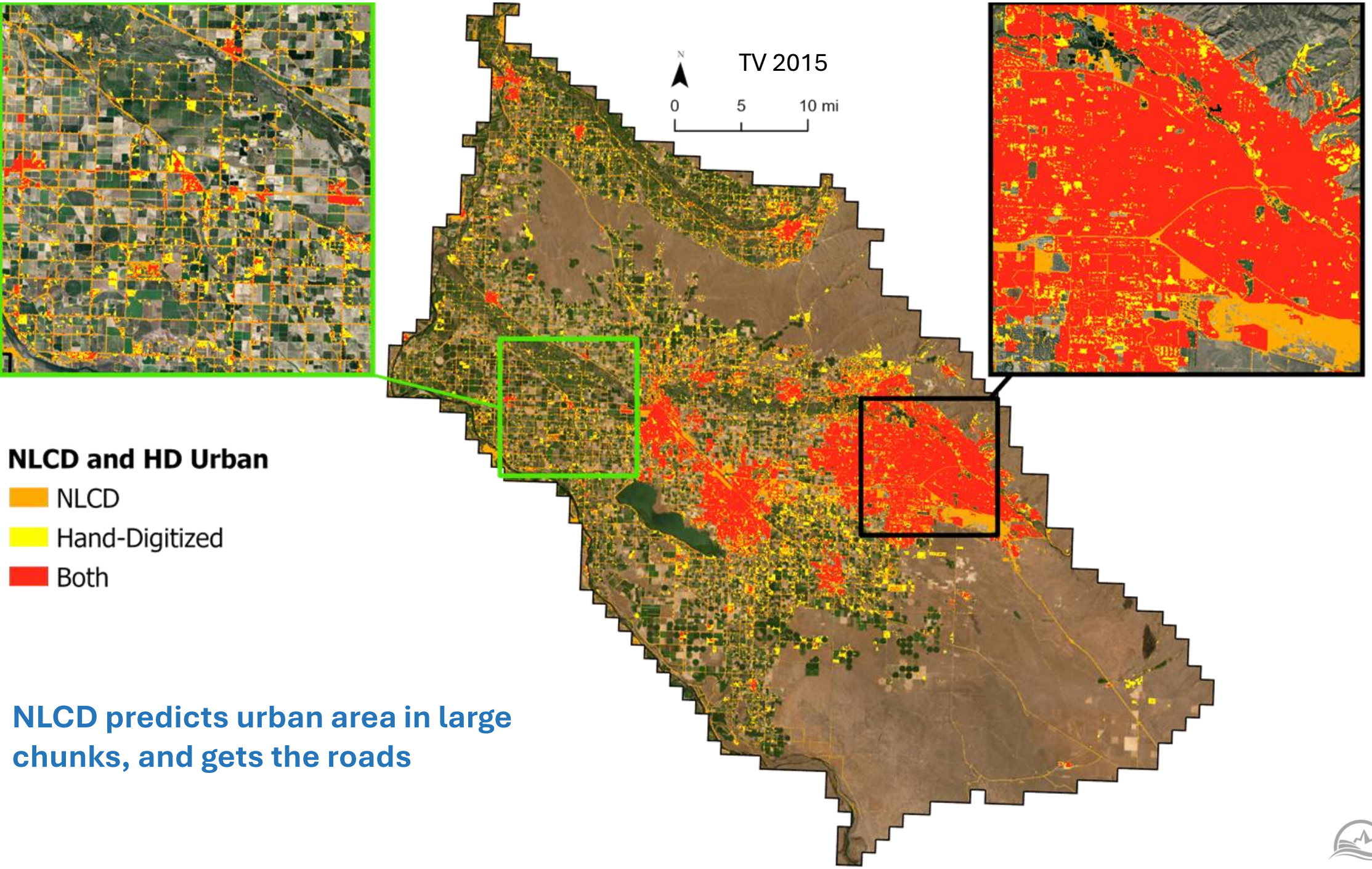
- Our model *can* predict urban area
- NLCD has tried and true methods to classify developed area
- Our model is tuned for irrigation
  - Agricultural and urban irrigation, anywhere water is applied
- The best method we found is to combine NLCD urban area and IDWRRF irrigation



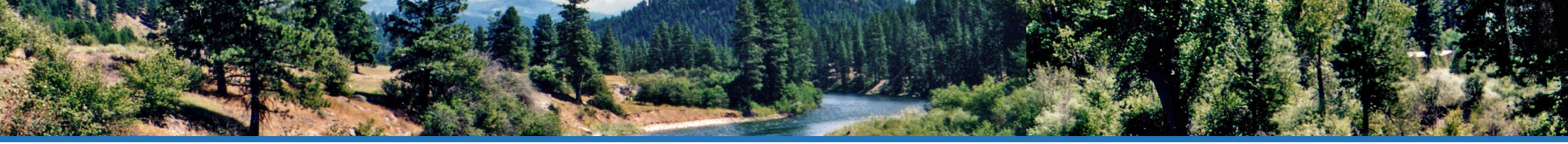
IDAHO DEPARTMENT OF WATER RESOURCES



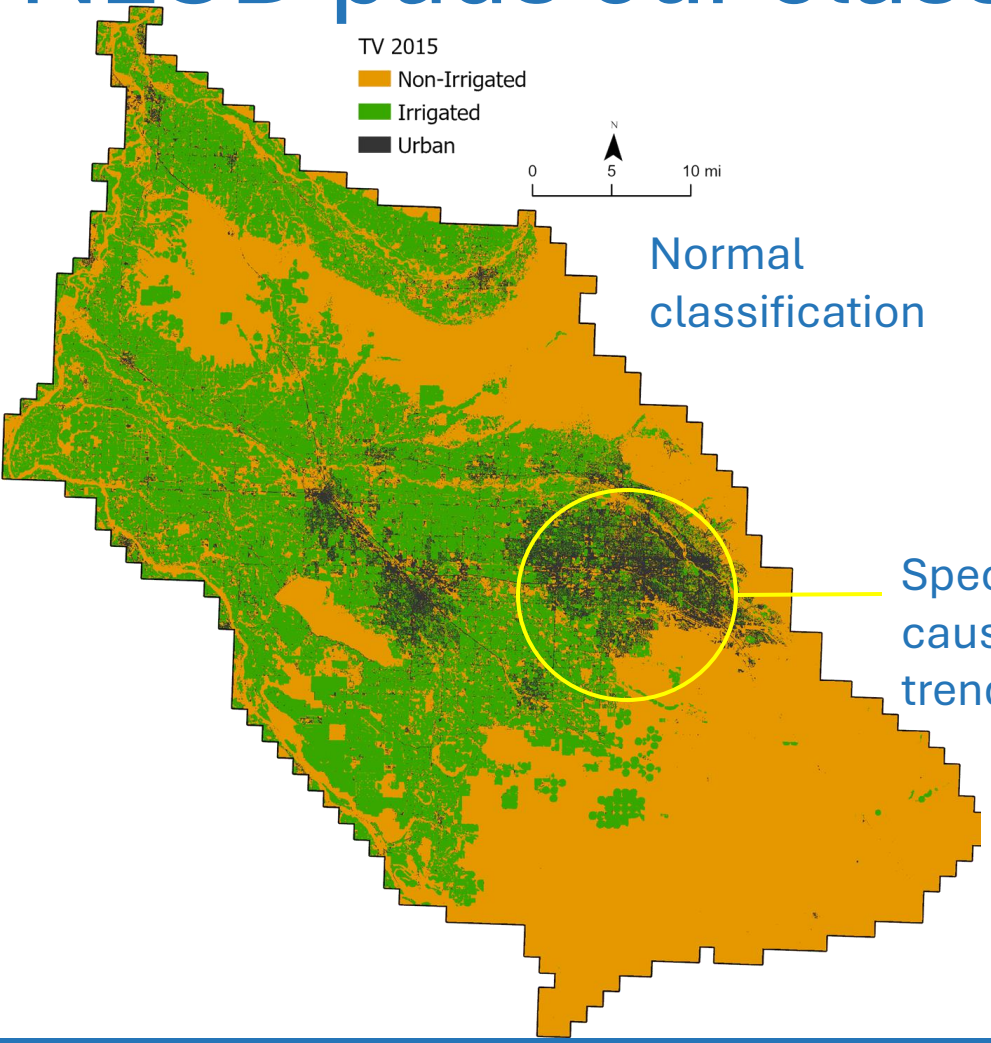
HD predicts lots of semi-irrigation in urban areas and around fields



NLCD predicts urban area in large chunks, and gets the roads

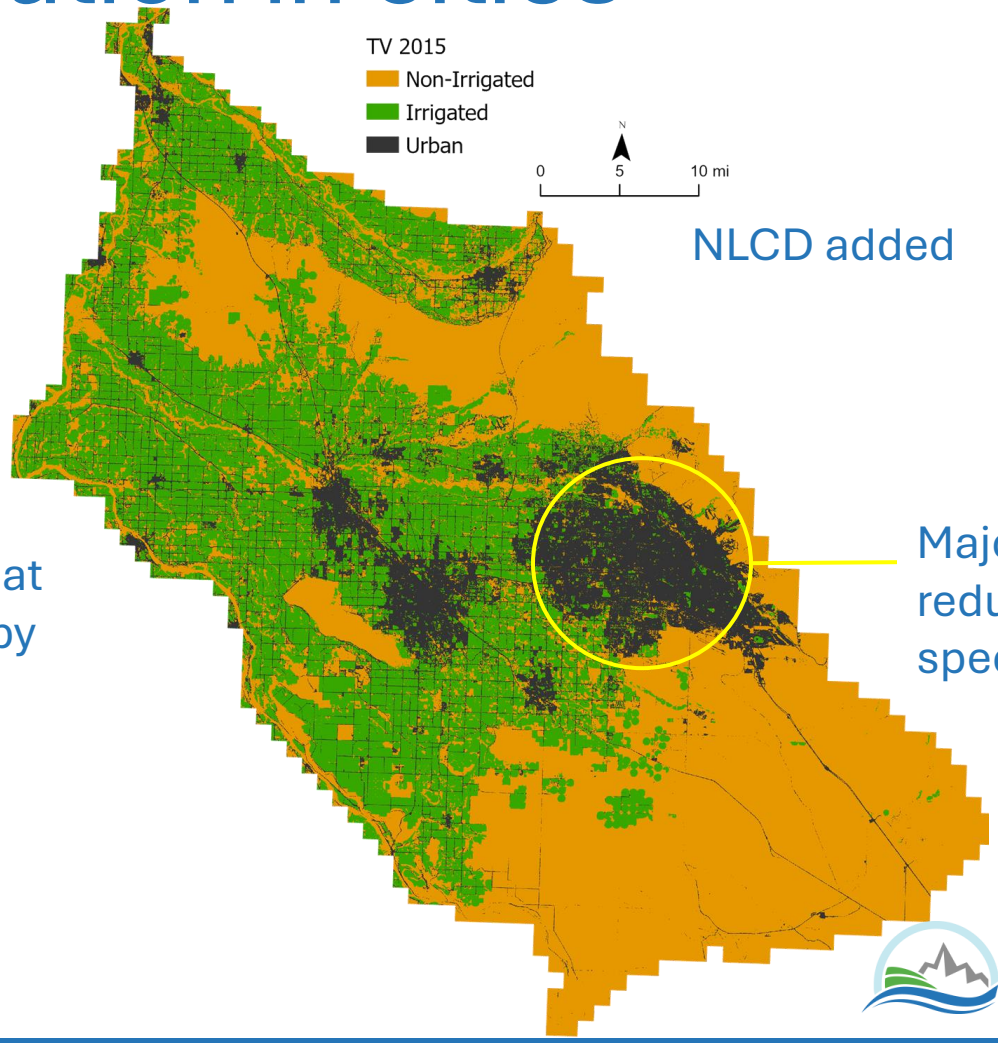


NLCD pads our classification in cities



Normal classification

Speckling that causes jumpy trends

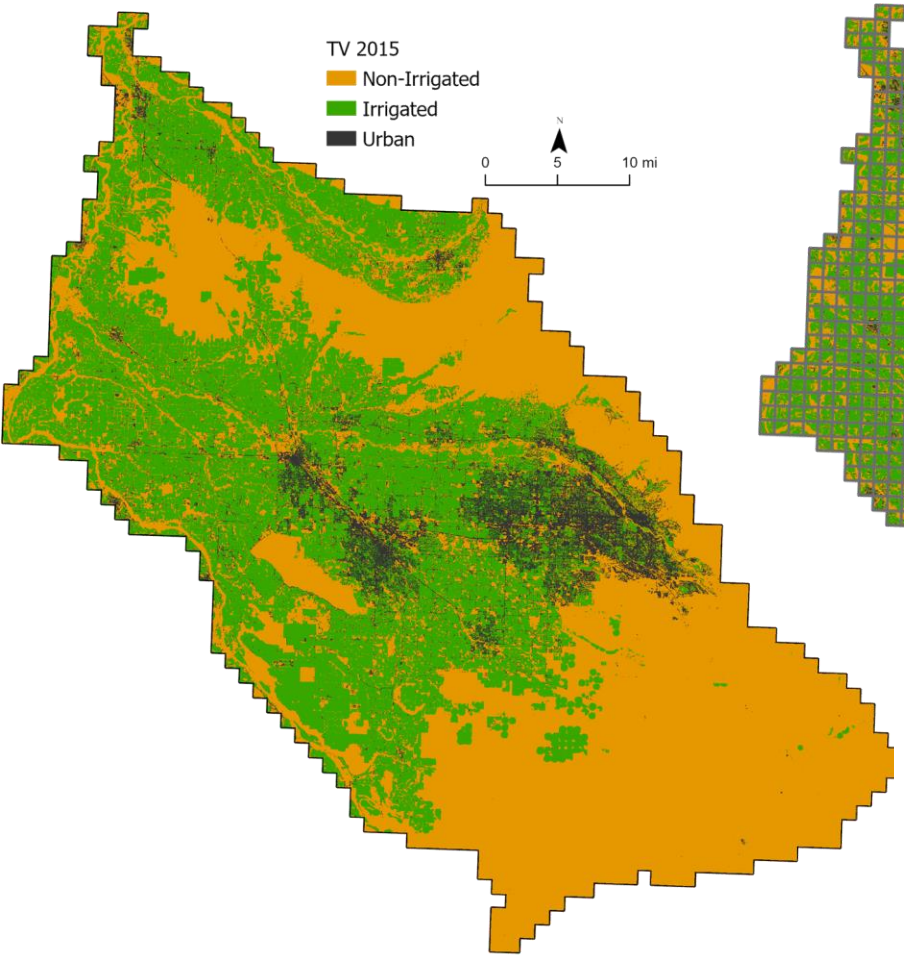


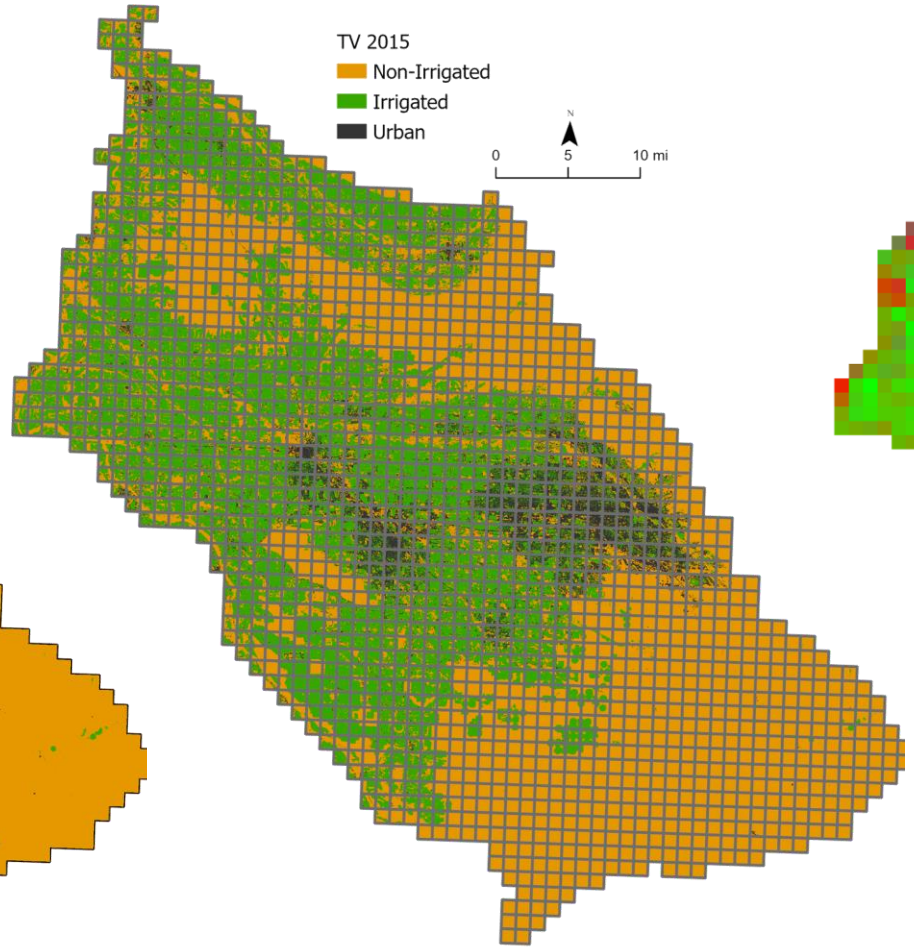
NLCD added

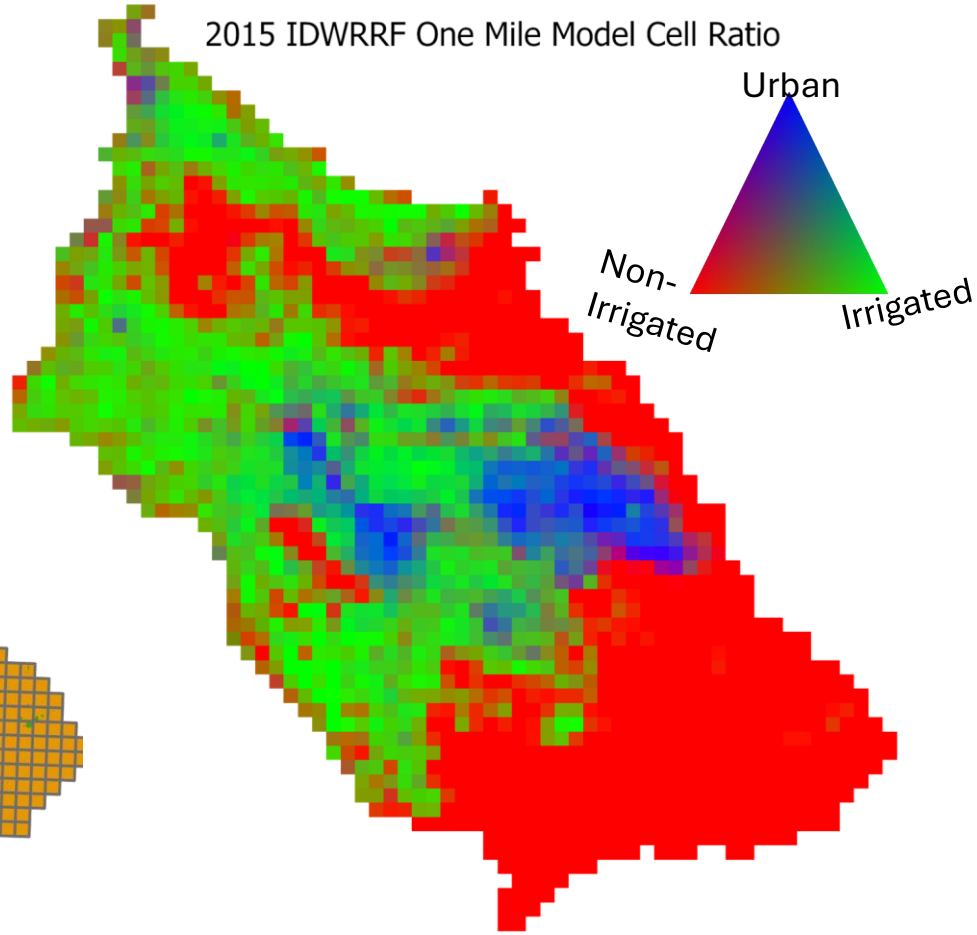
Major reduction in speckling

IDAHO DEPARTMENT OF WATER RESOURCES

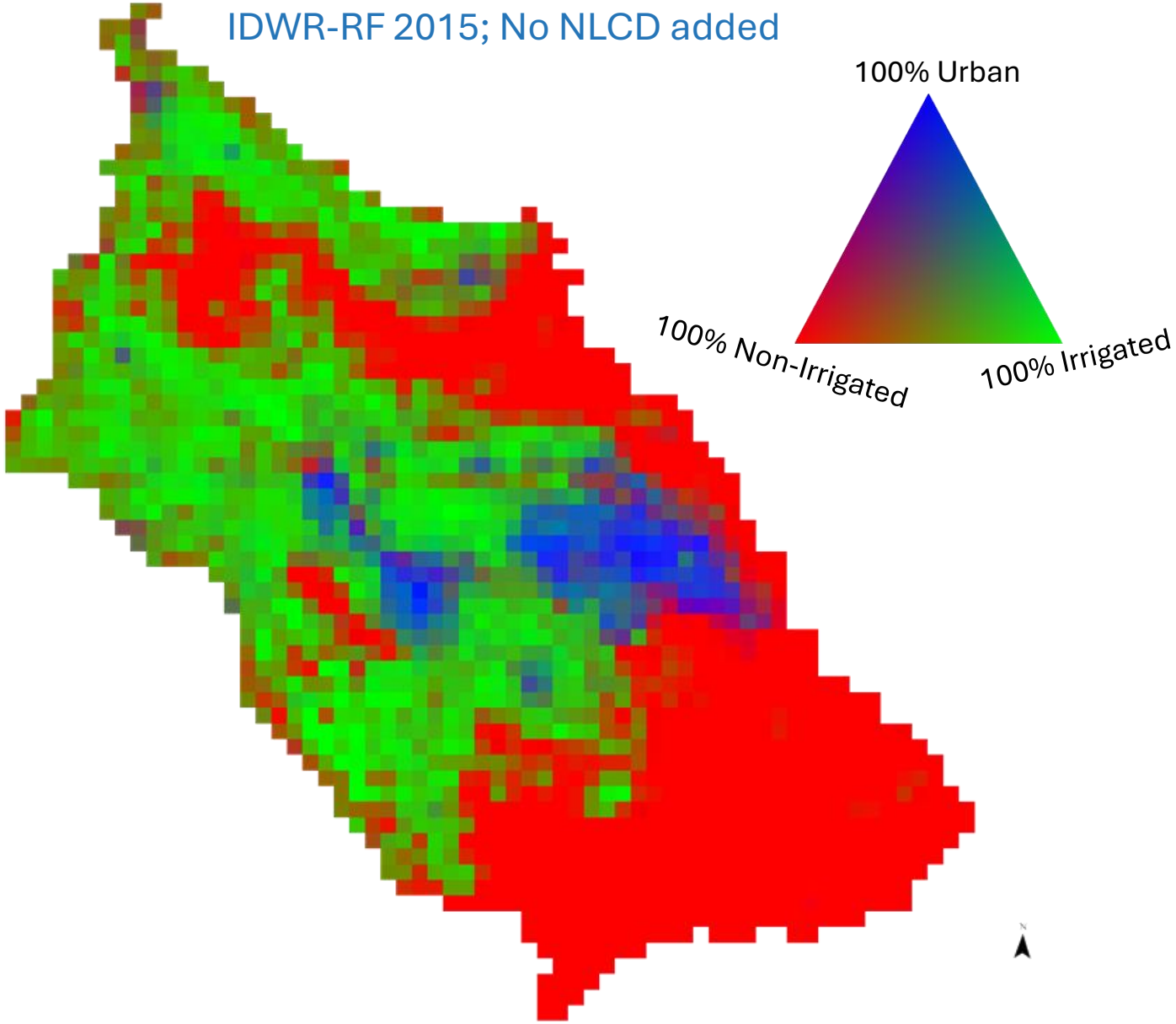
RF Classification != GWM Classification



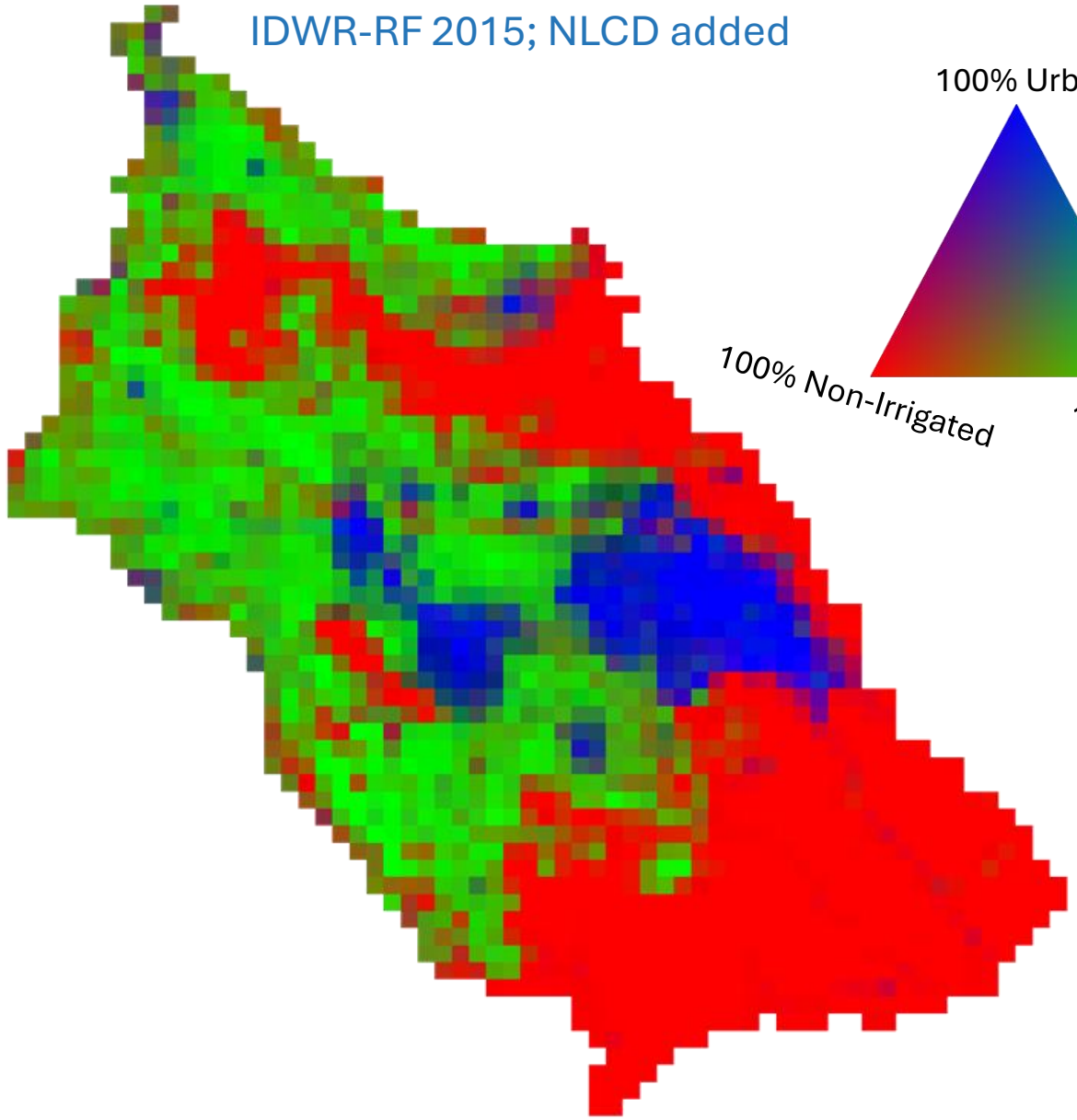


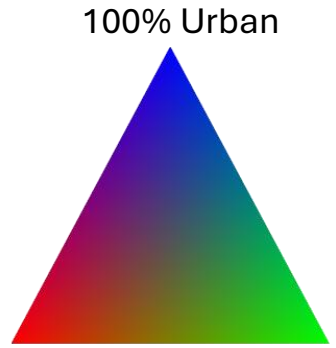


IDWR-RF 2015; No NLCD added

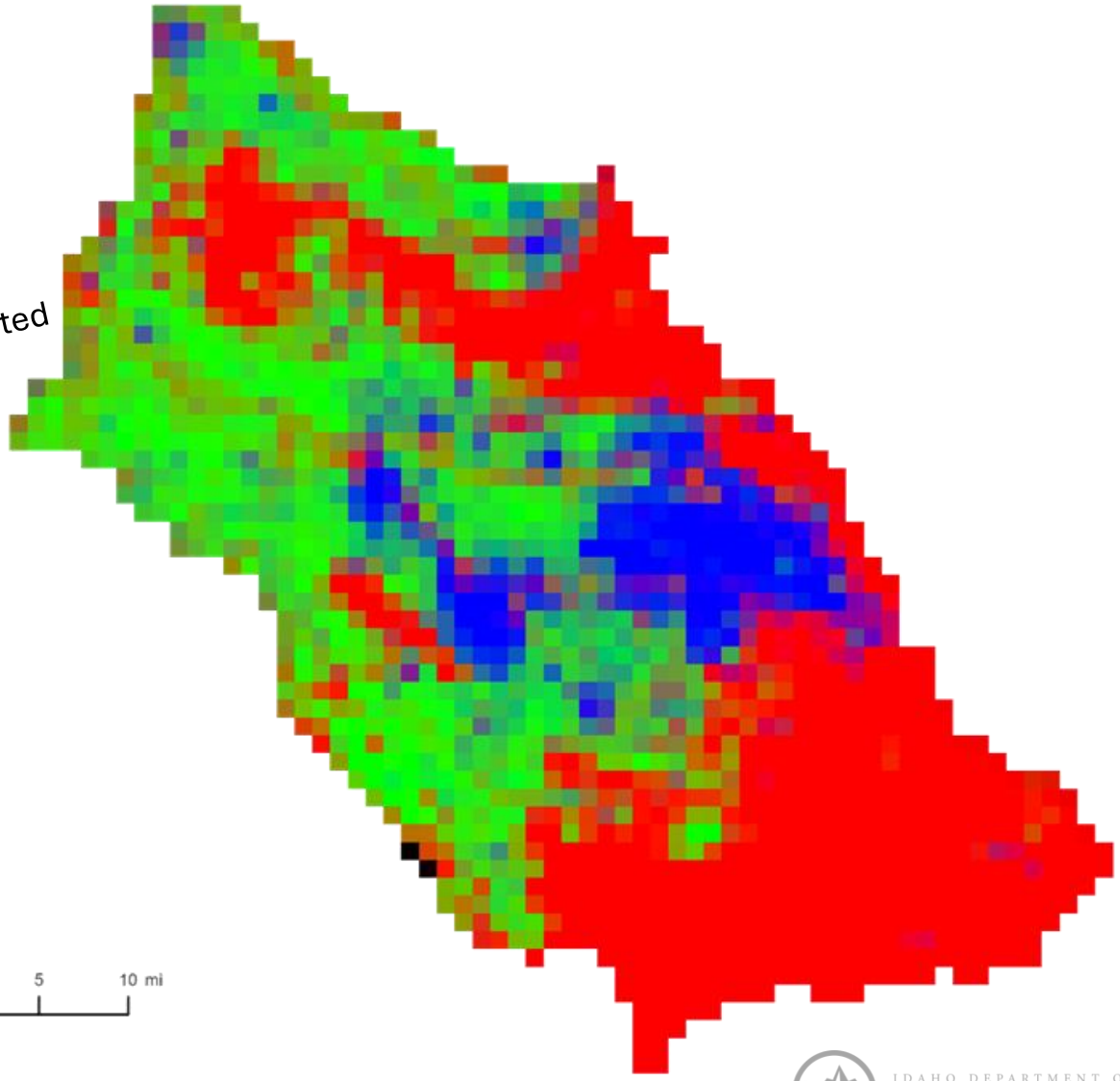


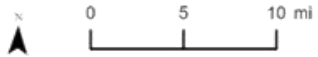
IDWR-RF 2015; NLCD added



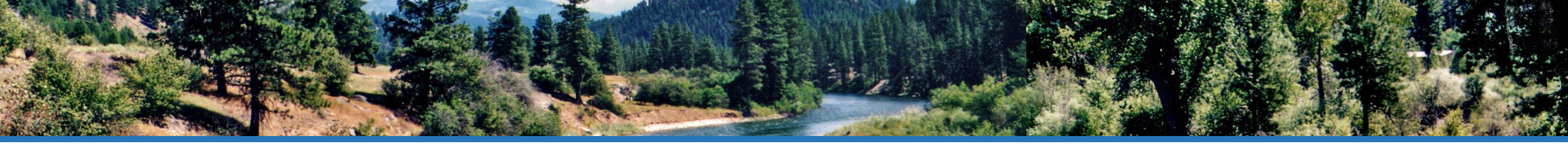


Hand Digitized 2015



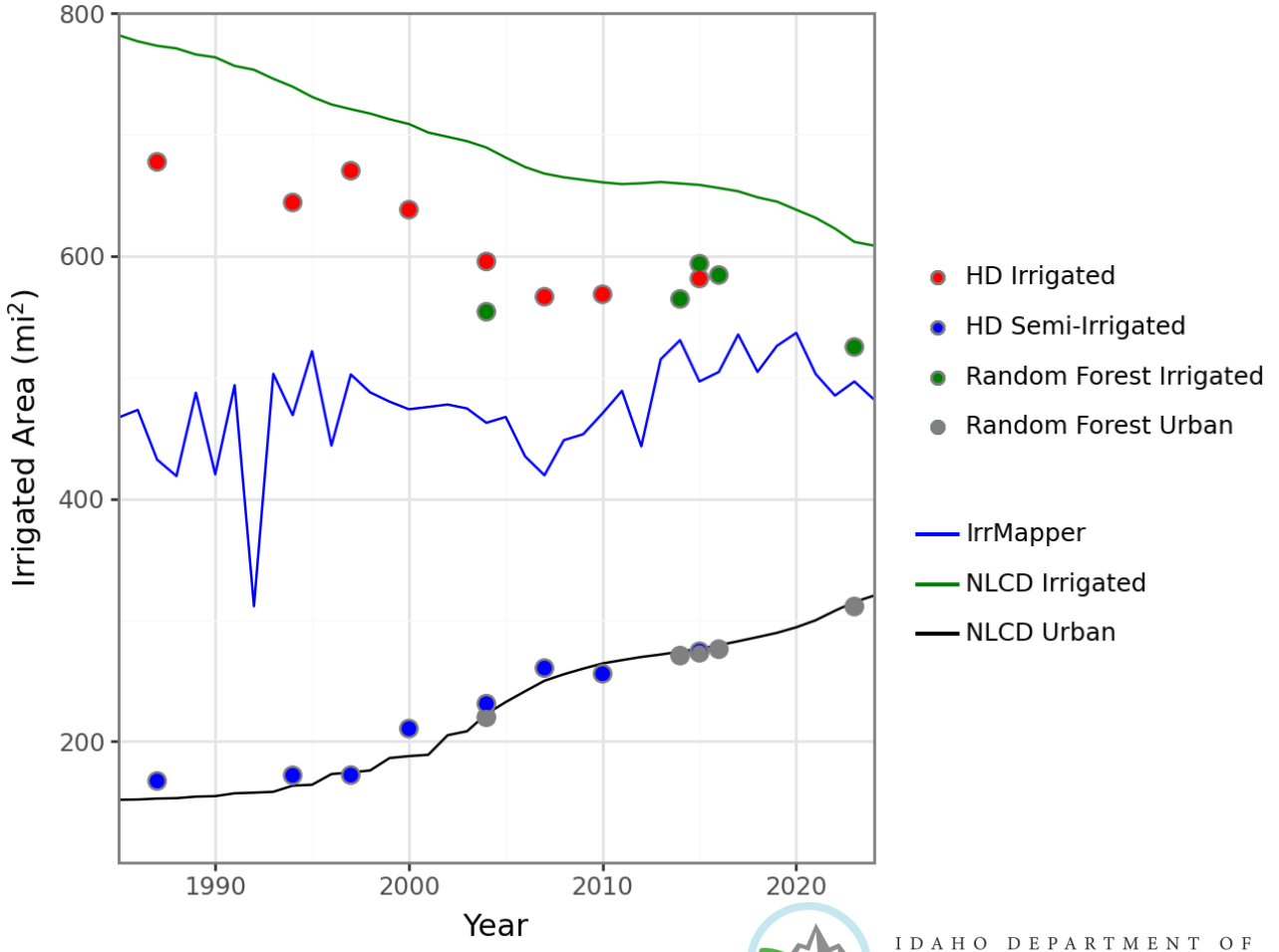


IDAHO DEPARTMENT OF WATER RESOURCES



We recommend using IDWRRF and NLCD

- Paired models give the most accurate distribution of landcover
- IDWRRF predicts irrigation most accurately
- NLCD predicts developed area most accurately
- A combination model ensures accuracy and consistency over time



IDAHO DEPARTMENT OF WATER RESOURCES

IDAHO DEPARTMENT OF
WATER RESOURCES

Questions?