

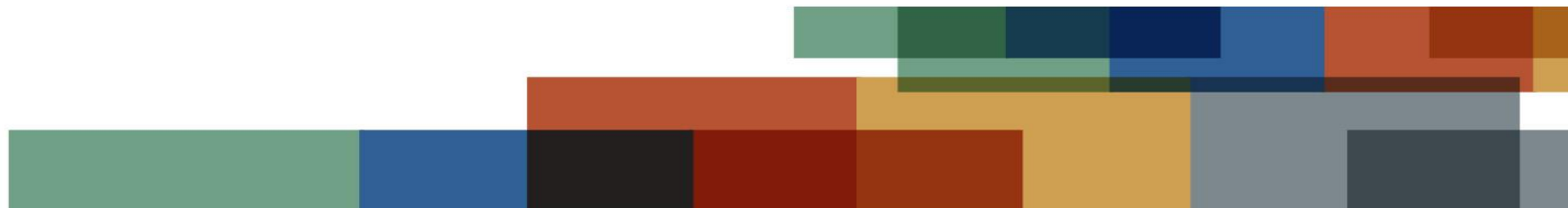


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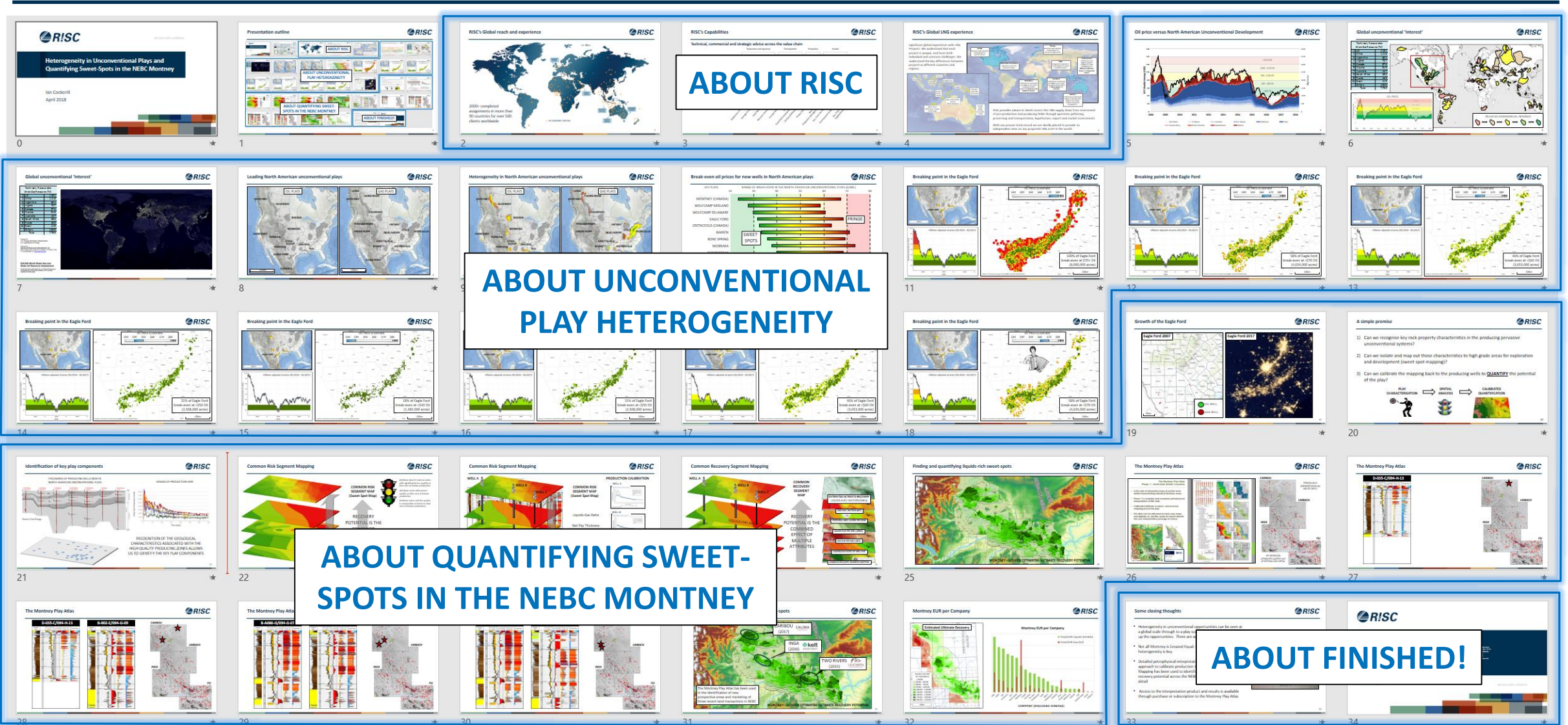
# Heterogeneity in Unconventional Plays and Quantifying Sweet-Spots in the NEBC Montney

Ian Cockerill

April 2018



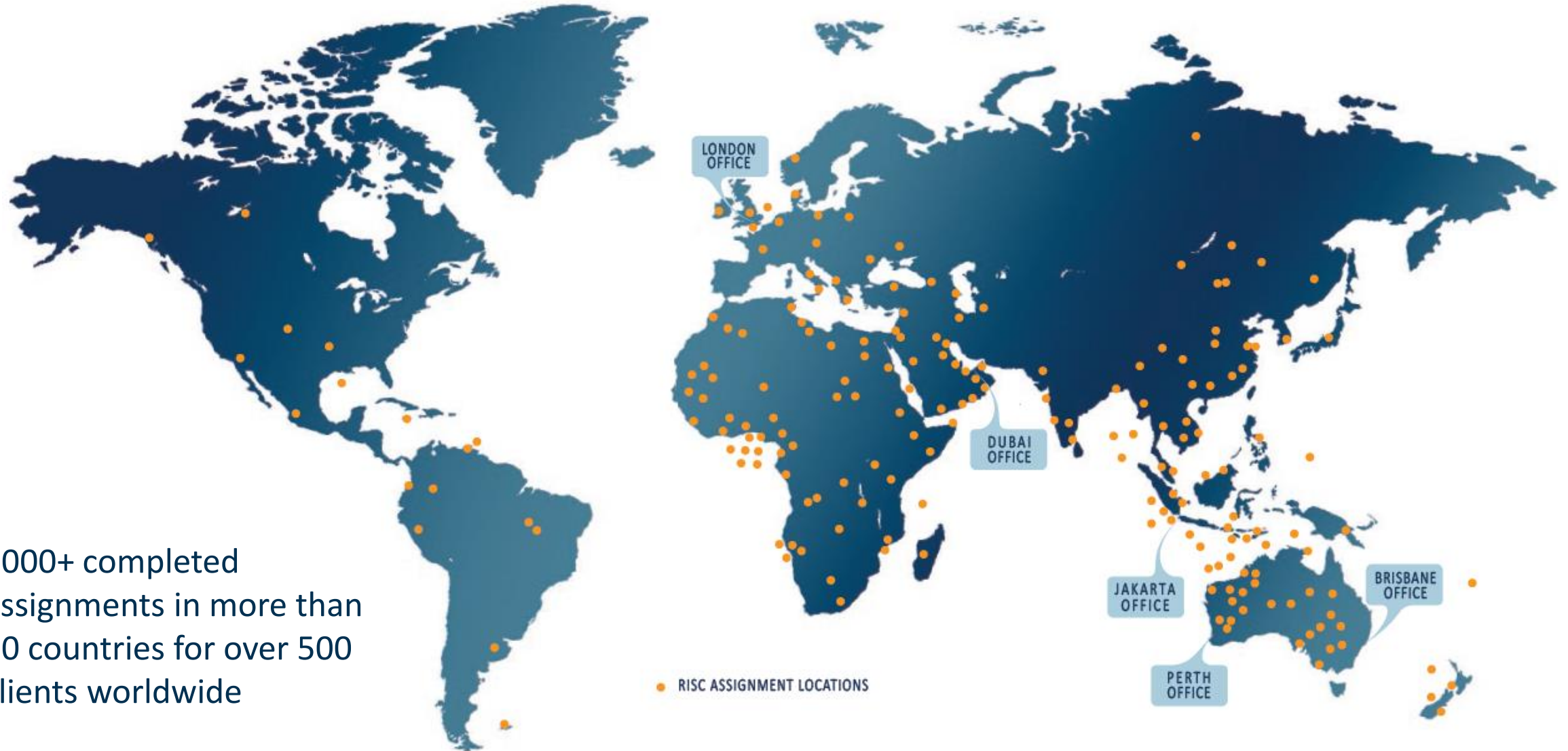
# Presentation outline



# RISC's Global reach and experience

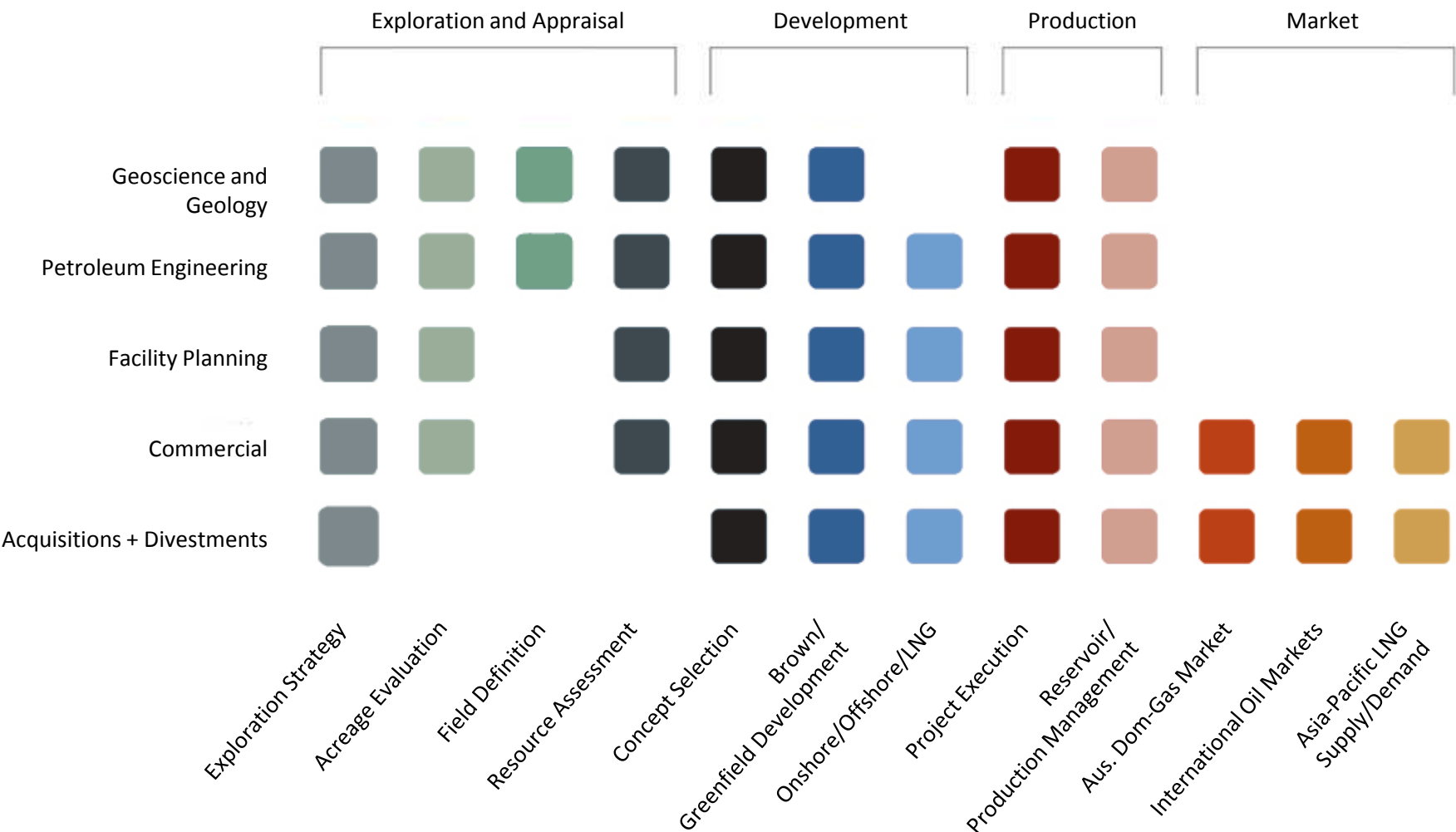


2000+ completed assignments in more than 90 countries for over 500 clients worldwide





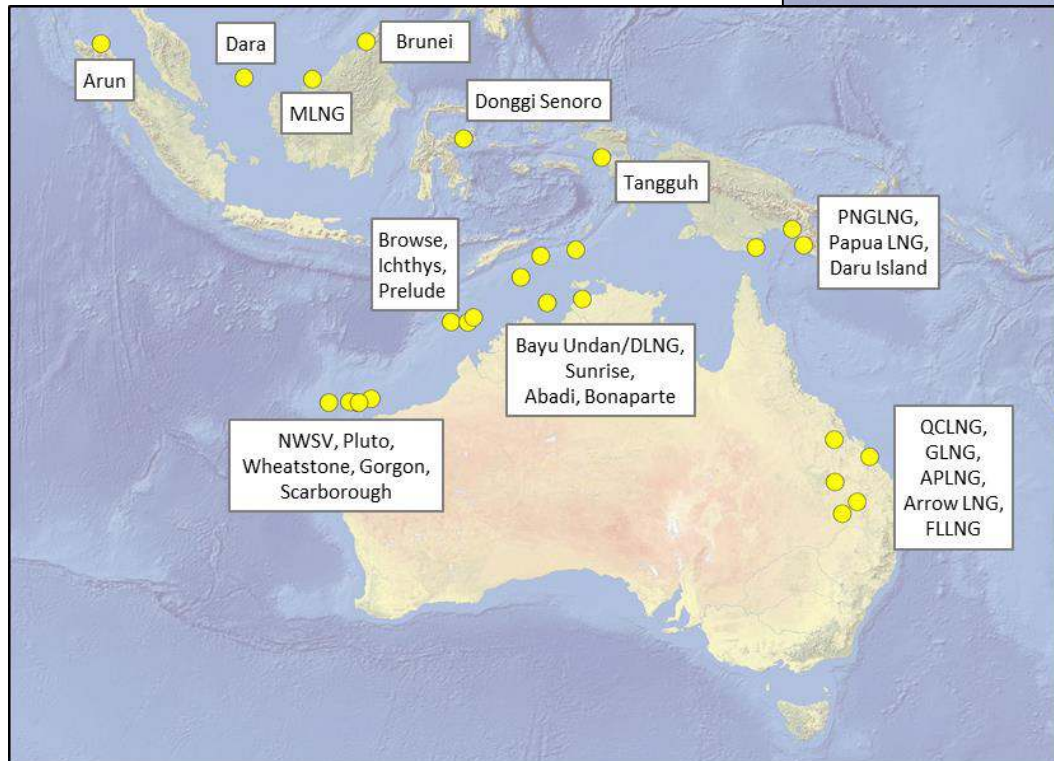
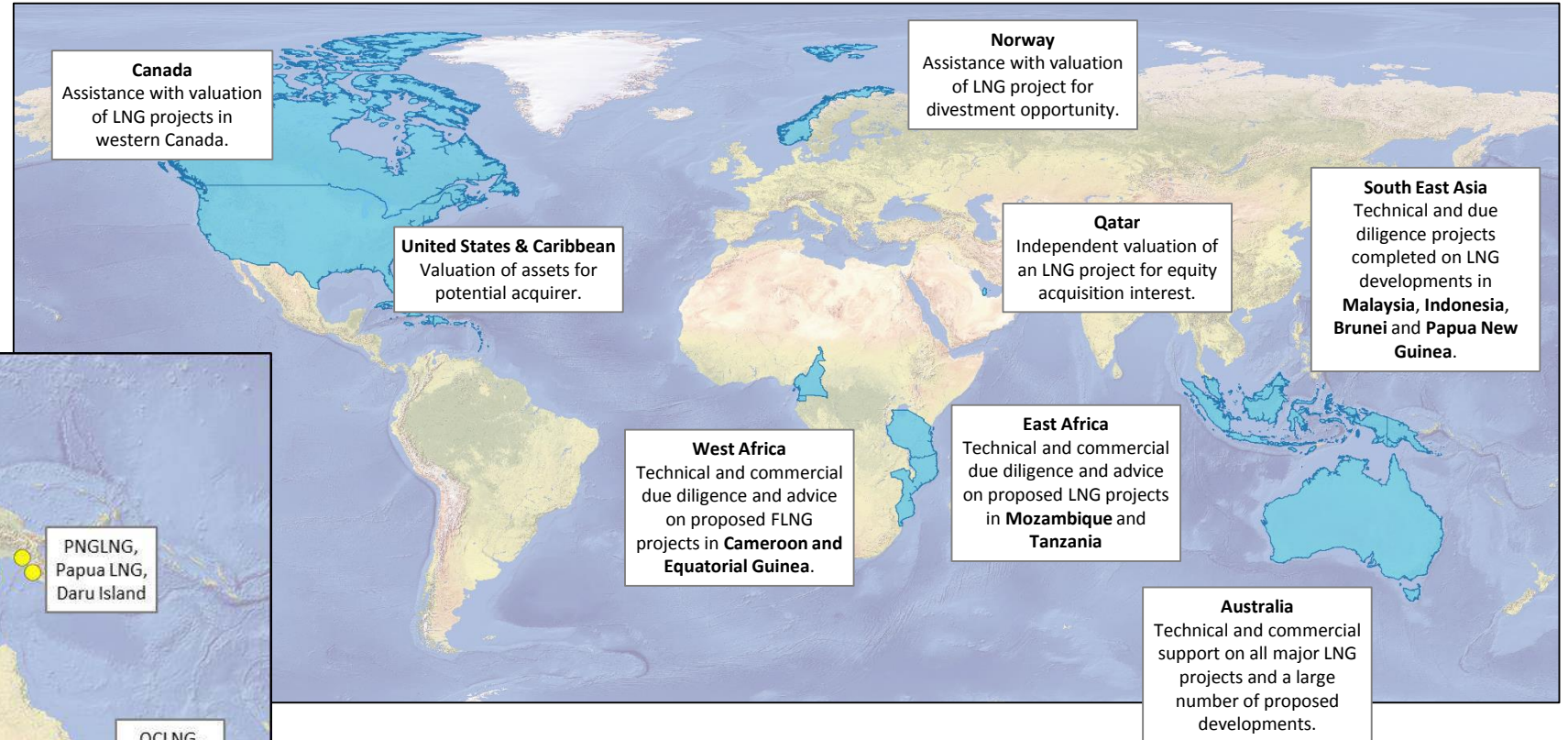
## Technical, commercial and strategic advice across the value chain



# RISC's Global LNG experience



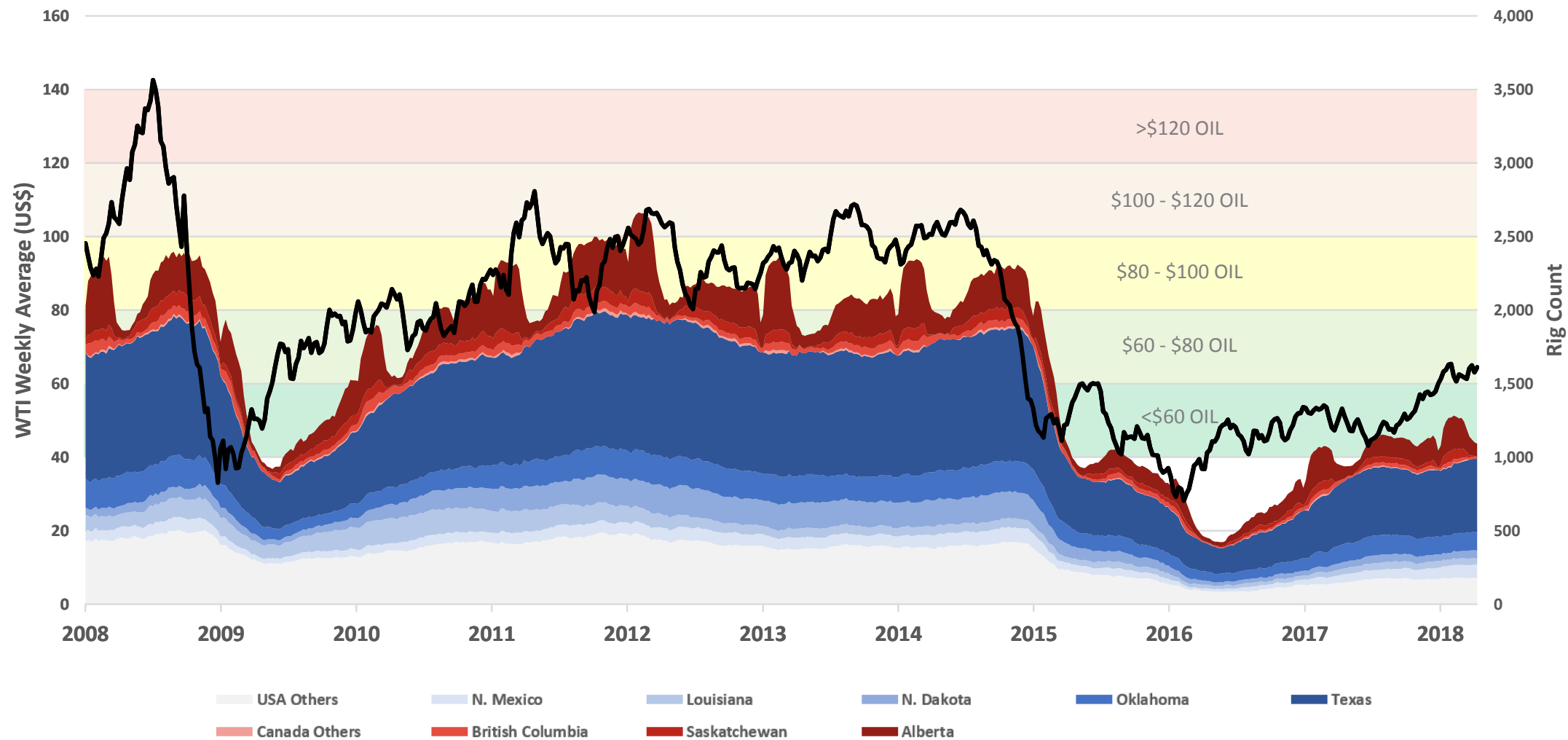
Significant global experience with LNG Projects. We understand that each project is unique, and faces both individual and common challenges. We understand the key differences between projects in different countries and regions.



RISC provides advice to clients across the LNG supply chain from assessment of pre-production and producing fields through upstream gathering, processing and transportation, liquefaction, export and market assessments.

With our proven track record we are ideally placed to provide an independent view on any proposed LNG asset in the world.

# Oil price versus North American Unconventional Development

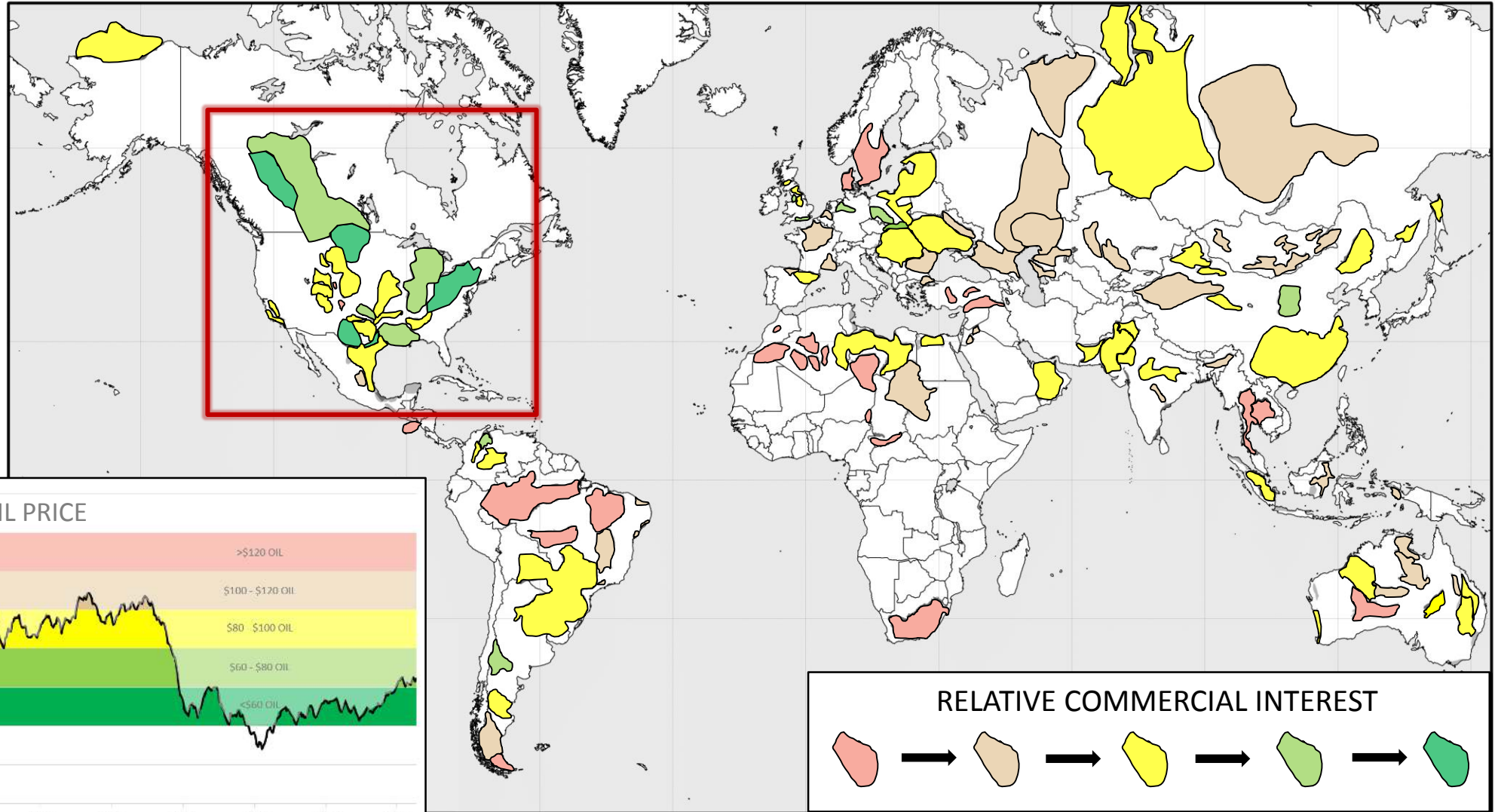




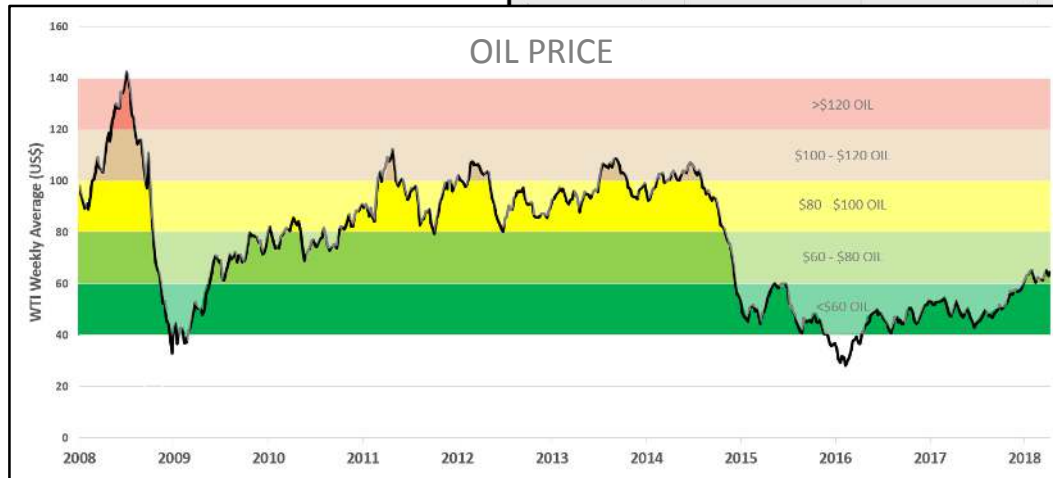
# Global unconventional 'interest'

Technically Recoverable  
Shale Gas Resource (Tcf)

1	US	1,161
2	China	1,115
3	Argentina	802
4	Algeria	707
5	Canada	573
6	Mexico	545
7	Australia	437
8	South Africa	390
9	Russia	285
10	Brazil	245
	Others	1,535
	Total	7,795



OIL PRICE



# Global unconventional 'interest'

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Prepared for:  
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U.S. Department of Energy

Prepared by:  
**Advanced Resources International, Inc.**  
4501 Fairfax Drive, Suite 910, Arlington, VA 22203 USA  
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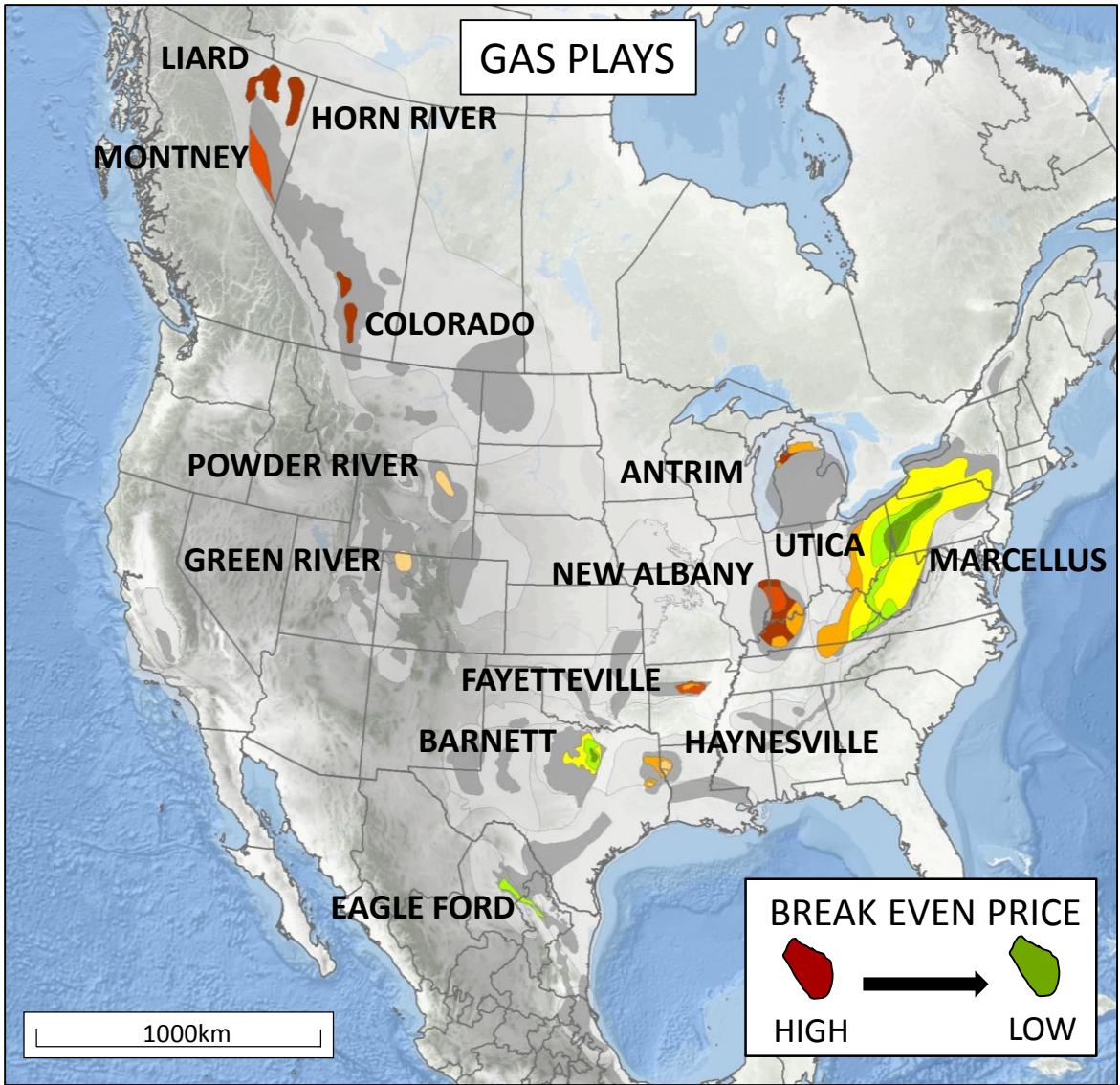
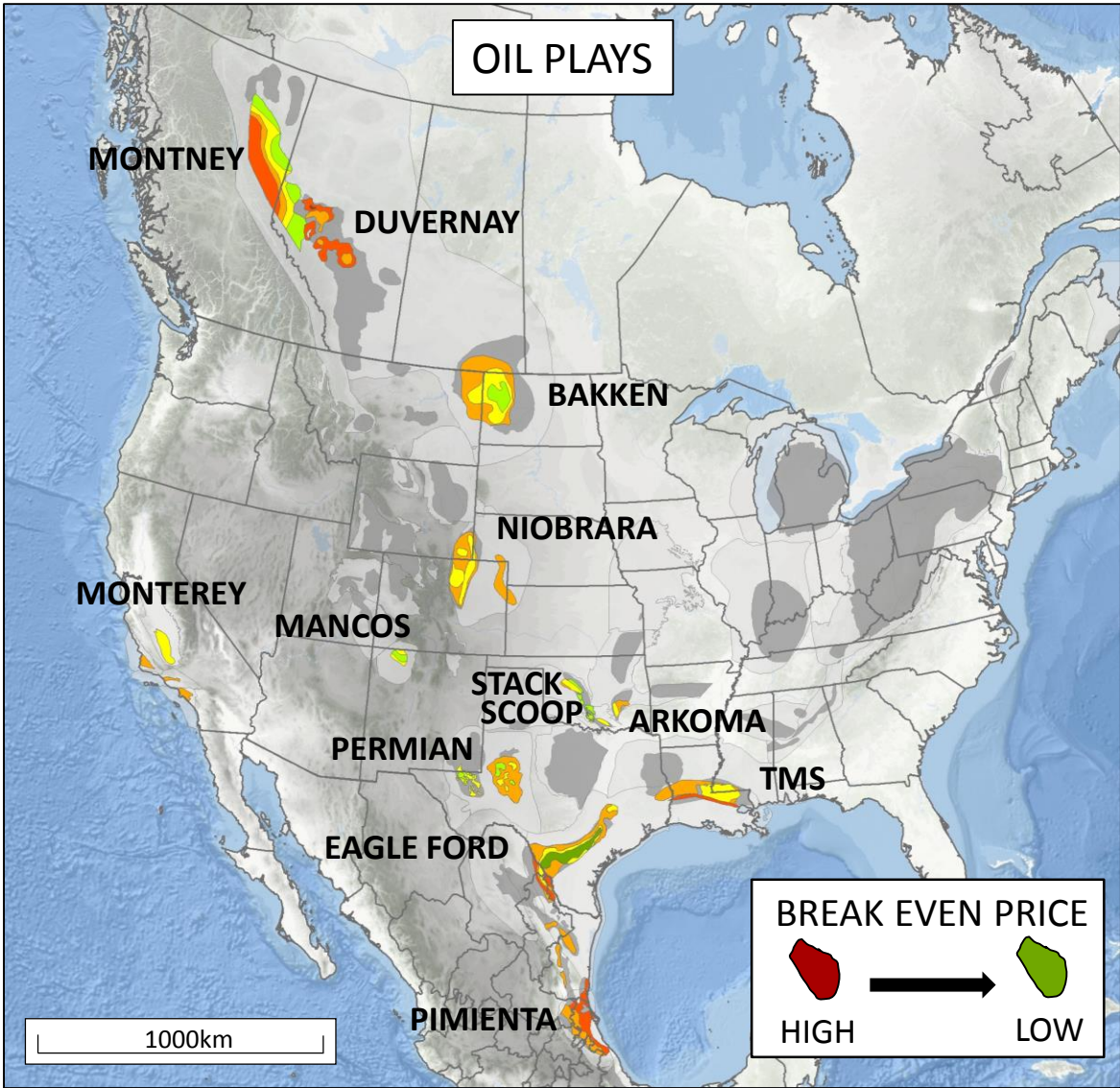
## EIA/ARI World Shale Gas and Shale Oil Resource Assessment

*Technically Recoverable Shale Gas and Shale Oil Resources:  
An Assessment of 137 Shale Formations in 41 Countries  
Outside the United States*



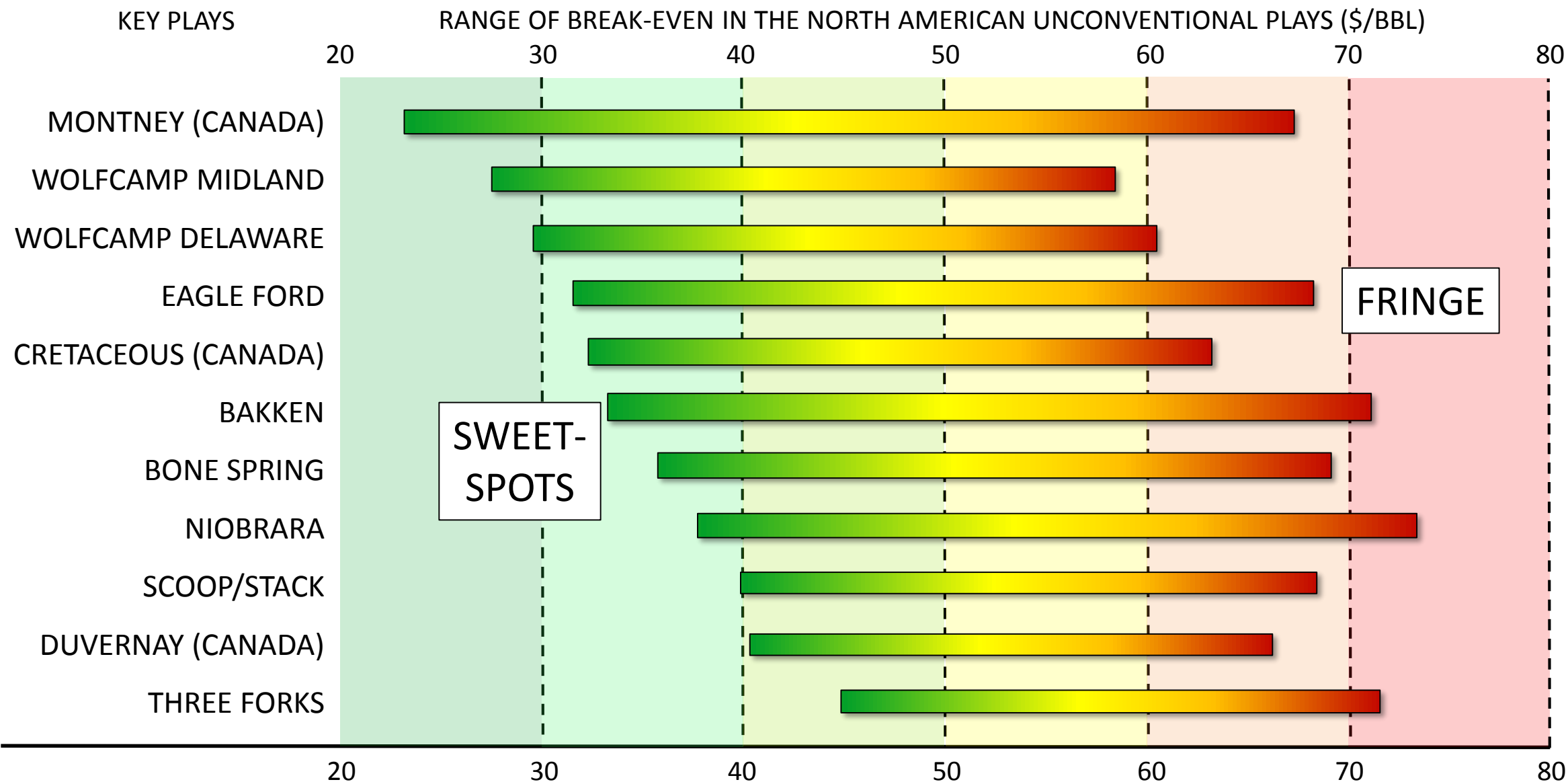


# Heterogeneity in North American unconventional plays



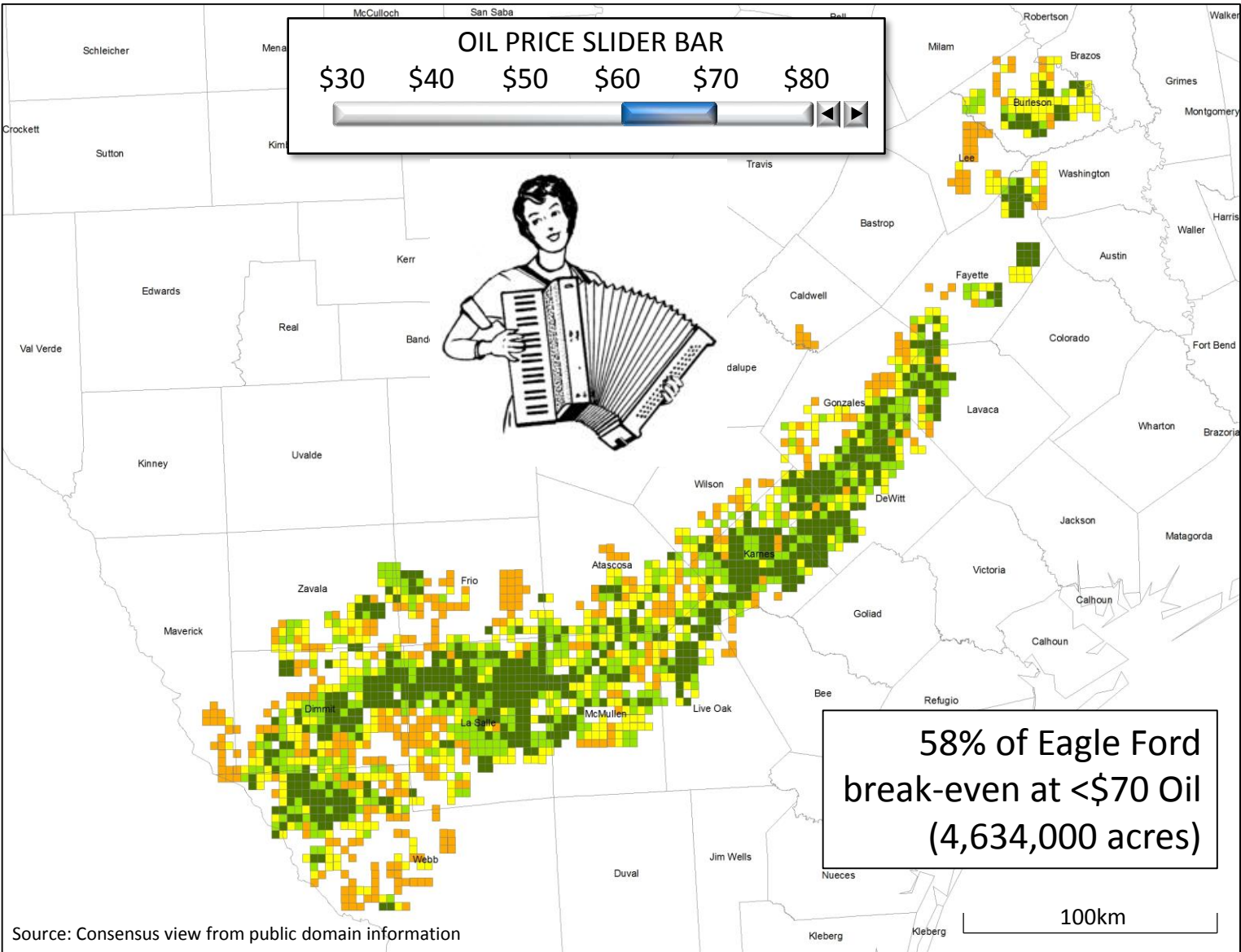
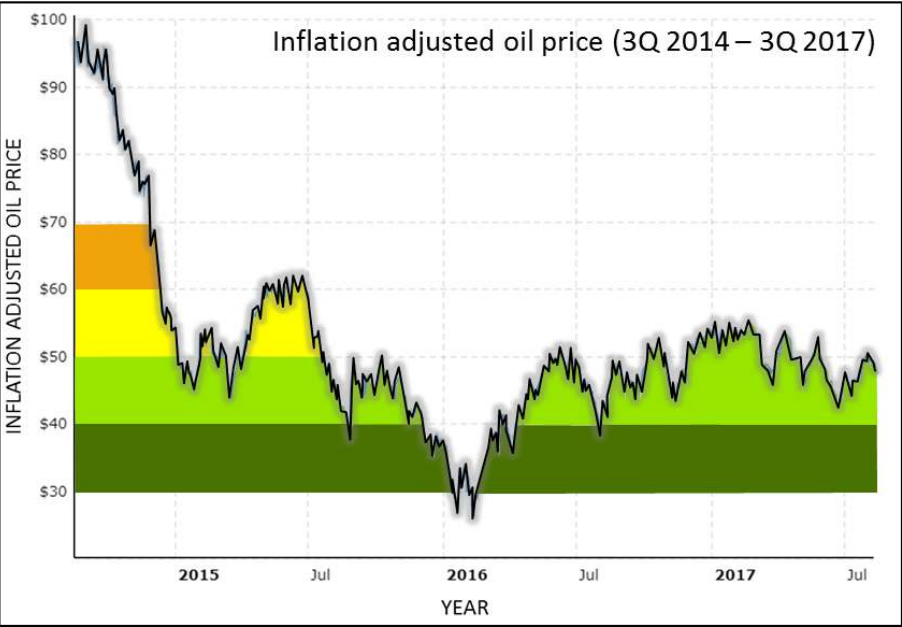
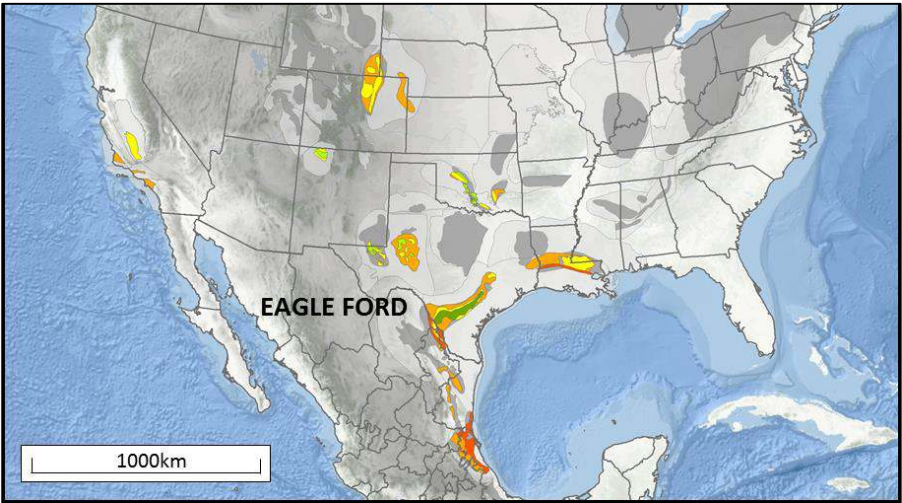
Source: Consensus view from public domain information

# Break-even oil prices for new wells in North American plays



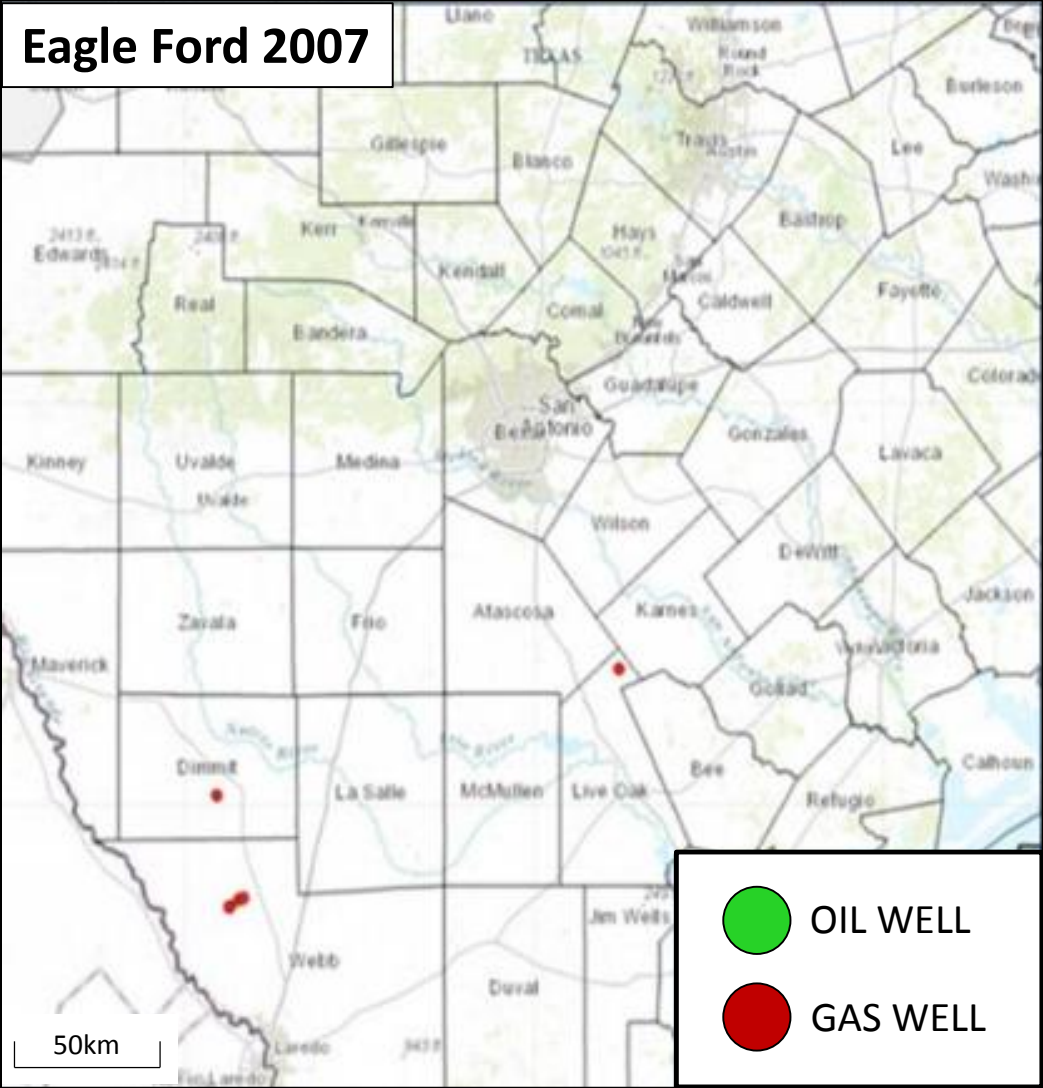


# Breaking point in the Eagle Ford



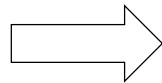
Source: Consensus view from public domain information



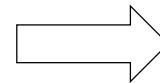


- 1) Can we recognise key rock property characteristics in the producing pervasive unconventional systems?
- 2) Can we isolate and map out those characteristics to high grade areas for exploration and development (sweet-spot mapping)?
- 3) Can we calibrate the mapping back to the producing wells to **QUANTIFY** the potential of the play?

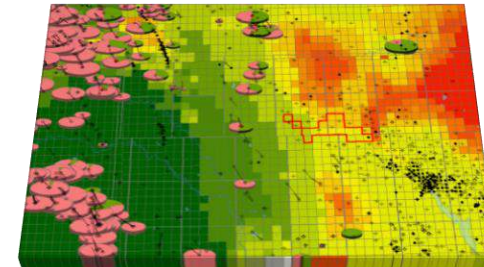
PLAY  
CHARACTERISATION



SPATIAL  
ANALYSIS



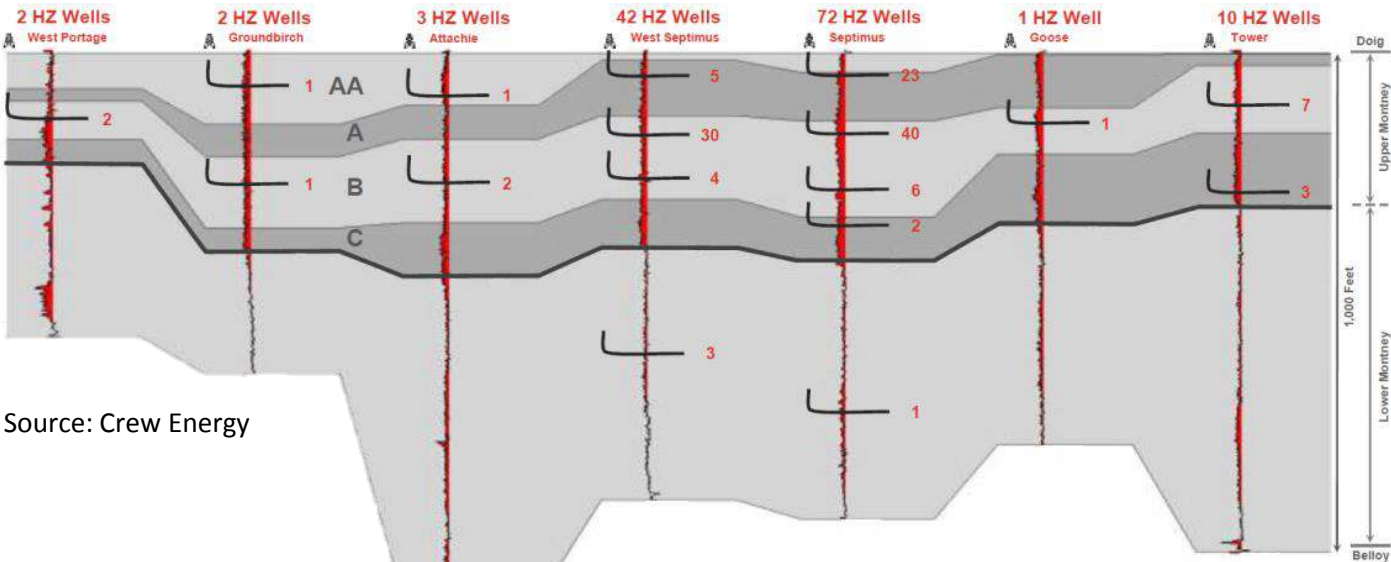
CALIBRATED  
QUANTIFICATION



# Identification of key play components

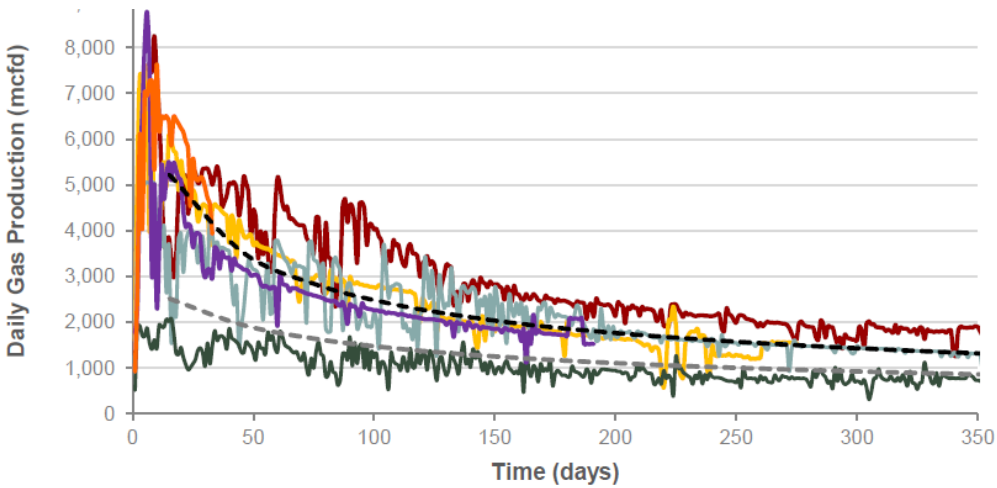


THOUSANDS OF PRODUCING WELLS NOW IN  
NORTH AMERICAN UNCONVENTIONAL PLAYS

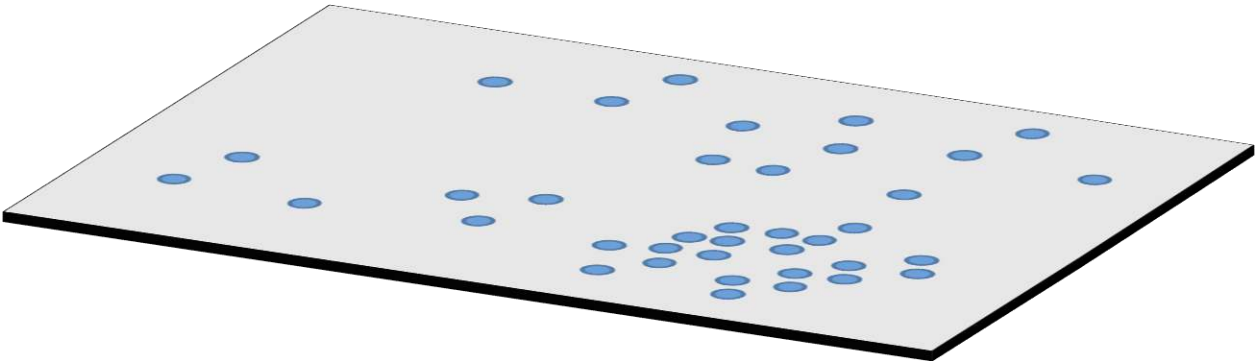


Source: Crew Energy

MASSES OF PRODUCTION DATA

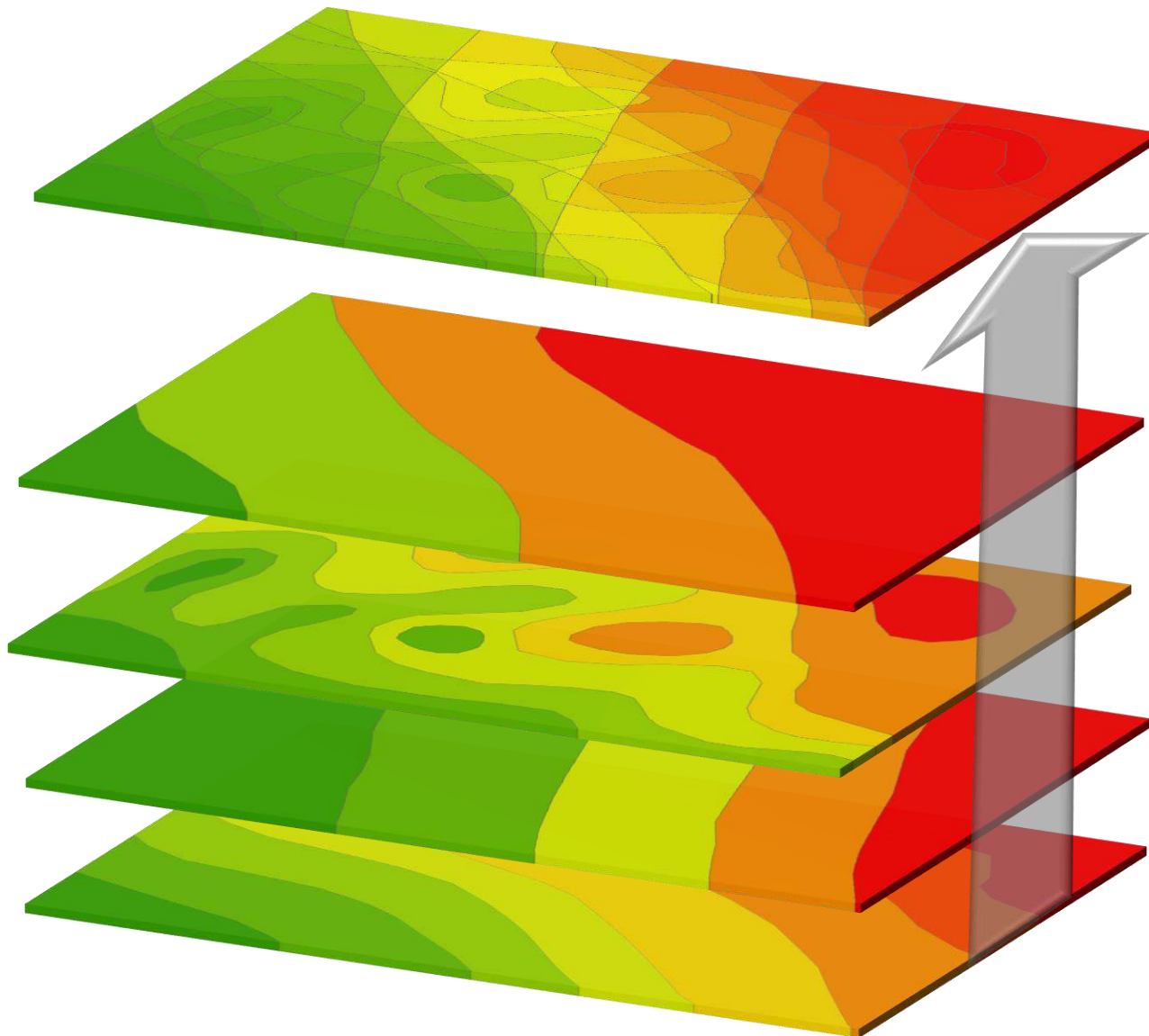


RECOGNITION OF THE GEOLOGICAL  
CHARACTERISTICS ASSOCIATED WITH THE  
HIGH QUALITY PRODUCING ZONES ALLOWS  
US TO IDENTIFY THE KEY PLAY COMPONENTS





# Common Risk Segment Mapping



**COMMON RISK  
SEGMENT MAP  
(Sweet Spot Map)**

RECOVERY  
POTENTIAL IS THE  
COMBINED  
EFFECT OF  
MULTIPLE  
ATTRIBUTES

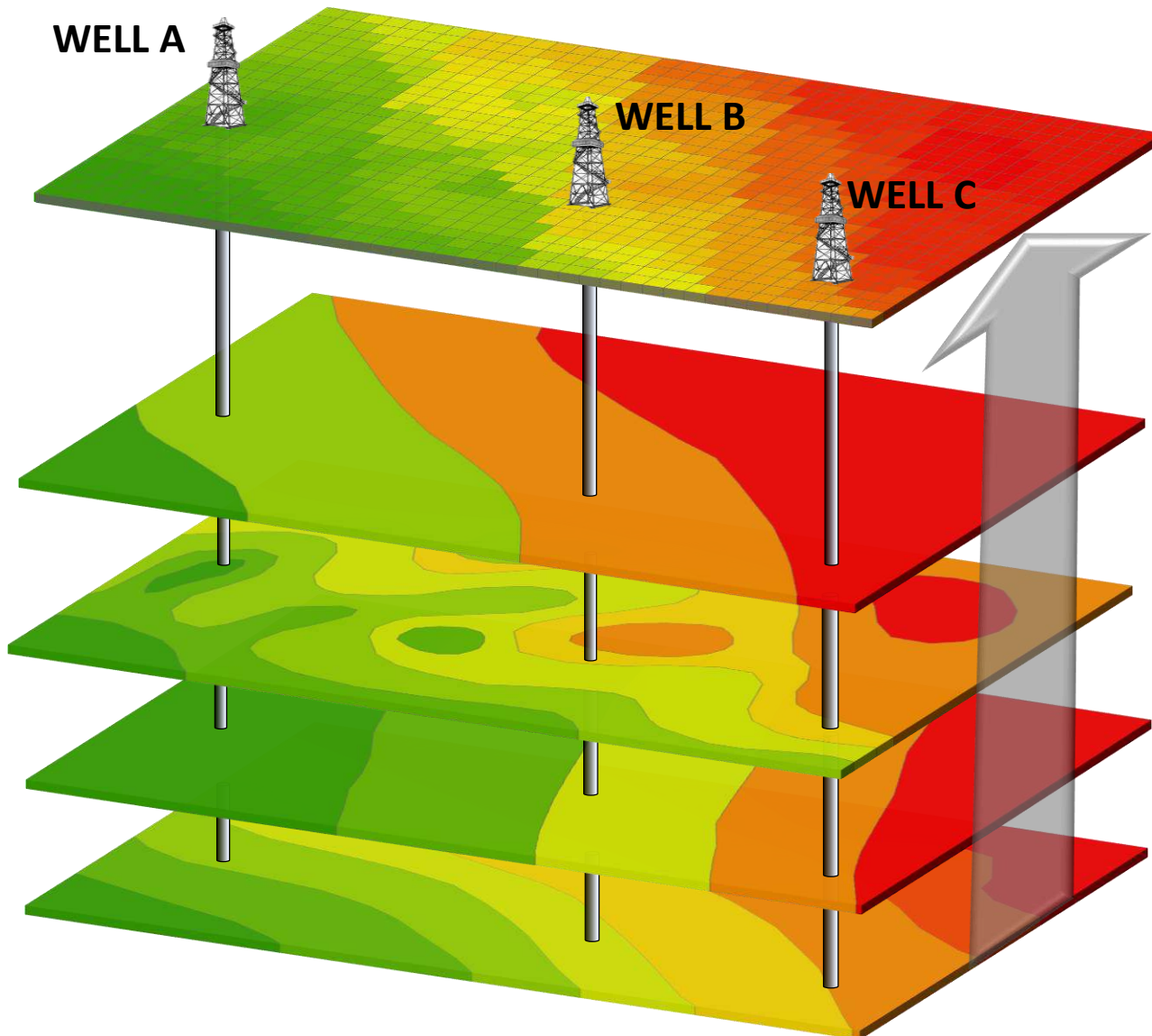


Attribute doesn't exist or exists with significantly less quality to that seen at known production

Attribute exists with poorer quality to that seen at known production

Attribute exists and the quality is comparable or better to that seen at known production

# Common Risk Segment Mapping



## COMMON RISK SEGMENT MAP (Sweet Spot Map)

Liquids-Gas Ratio

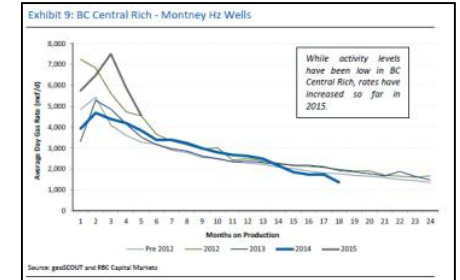
Net Pay Thickness (Porosity/Resistivity)

Depositional Environment

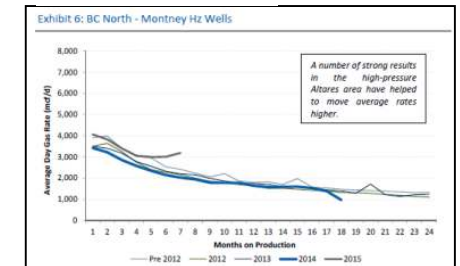
Pressure

## PRODUCTION CALIBRATION

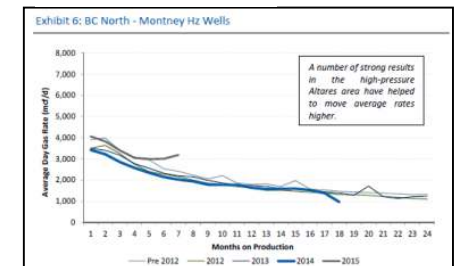
### WELL A



### WELL B

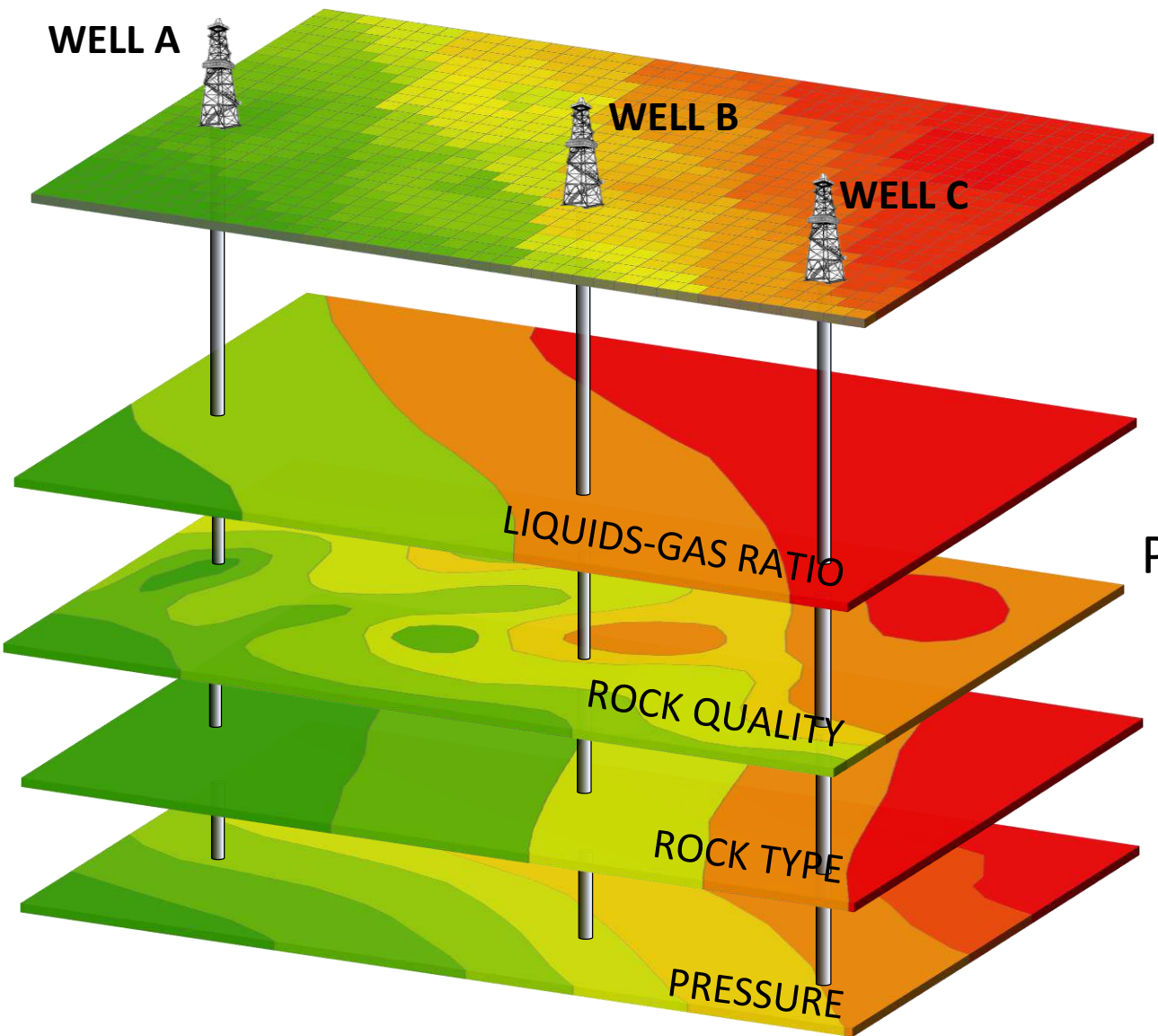


### WELL C



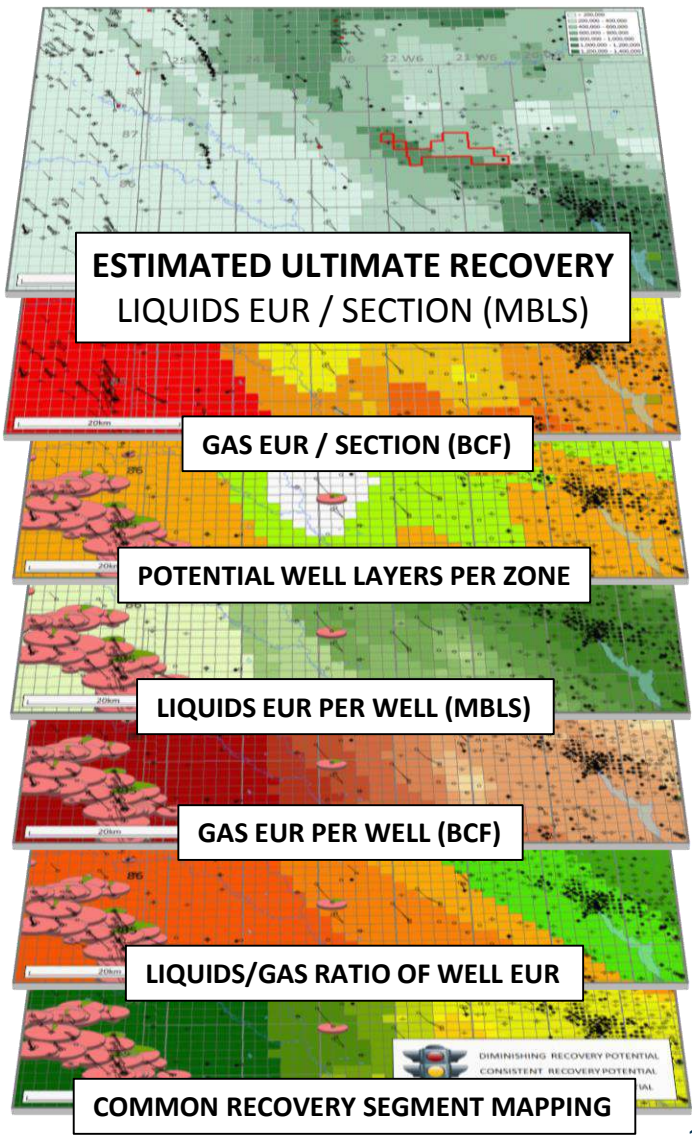


# Common Recovery Segment Mapping



COMMON  
RECOVERY  
SEGMENT  
MAP

RECOVERY  
POTENTIAL IS THE  
COMBINED  
EFFECT OF  
MULTIPLE  
ATTRIBUTES



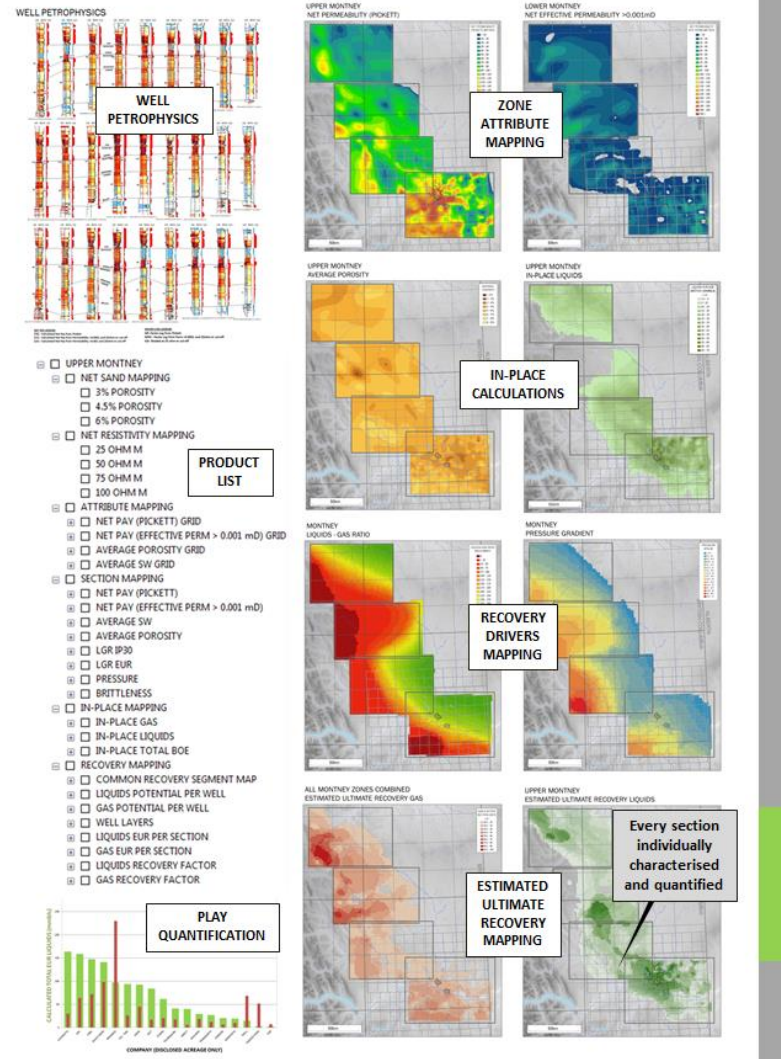
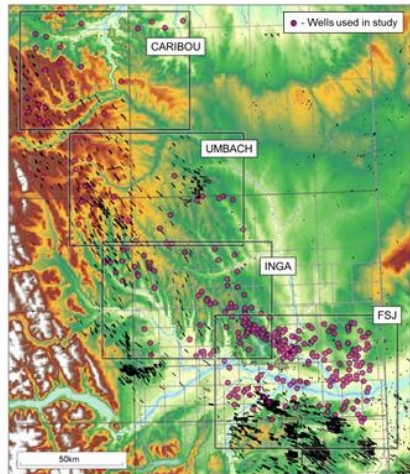


# The Montney Play Atlas

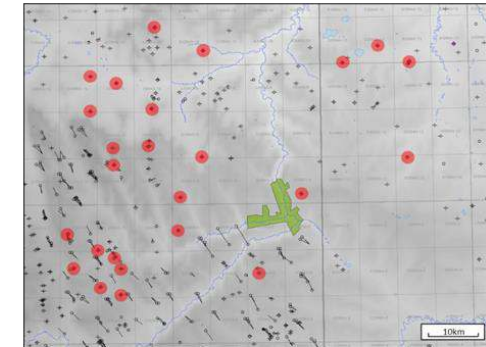


## The Montney Play Atlas Phase 1 – North-East British Columbia

- A full suite of interpreted maps at section level detail characterising individual Montney zones.
- Phase 1 is complete and comprises petrophysical interpretation of 400 wells.
- Calibrated attribute, in-place, and recovery mapping across the play.
- The atlas can be delivered as hard copy maps and digitally as .shp files ready for import directly into your interpretation package of choice.

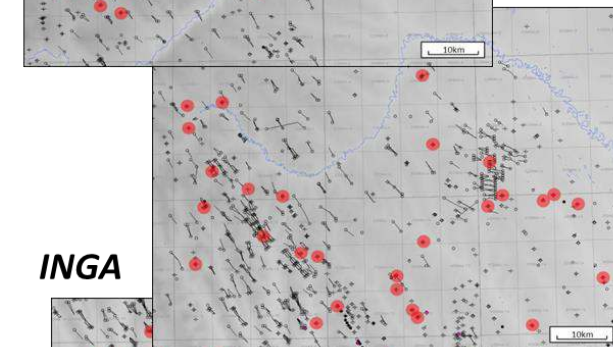


### CARIBOU

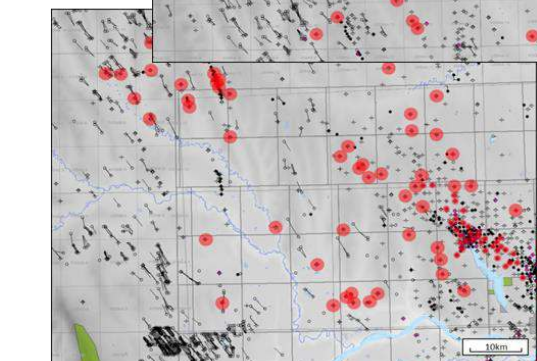


PETROPHYSICS  
INTERPRETATION ON  
400 KEY WELLS

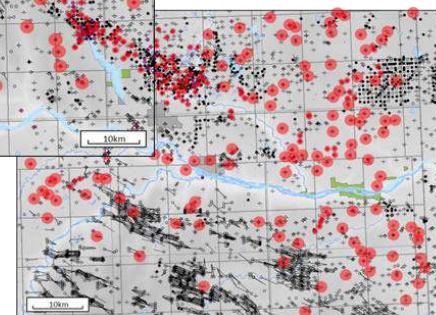
### UMBACH



### INGA

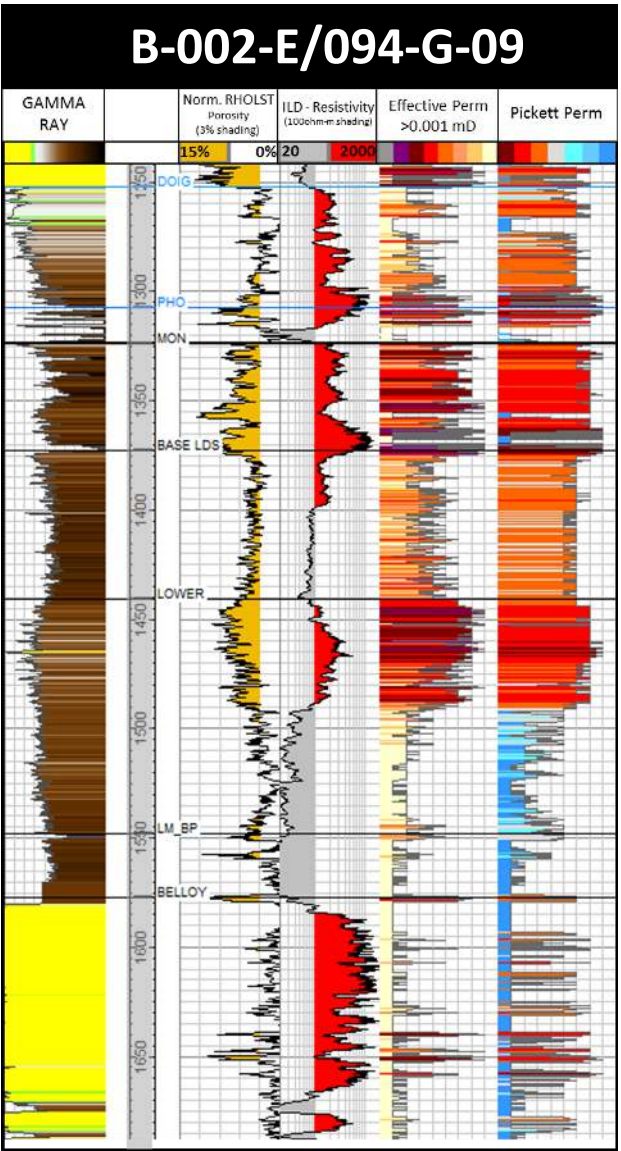
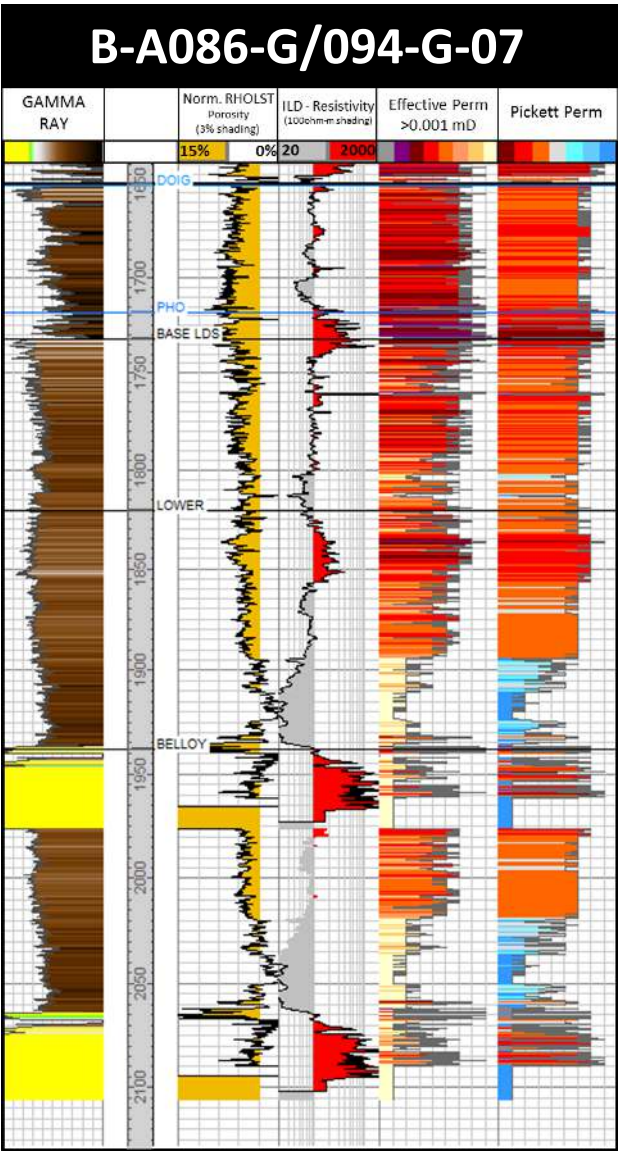


### FSJ

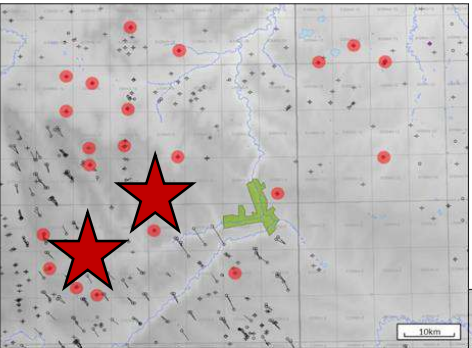


KEY RESERVOIR  
ATTRIBUTES MAPPED OUT  
AT SECTION LEVEL DETAIL

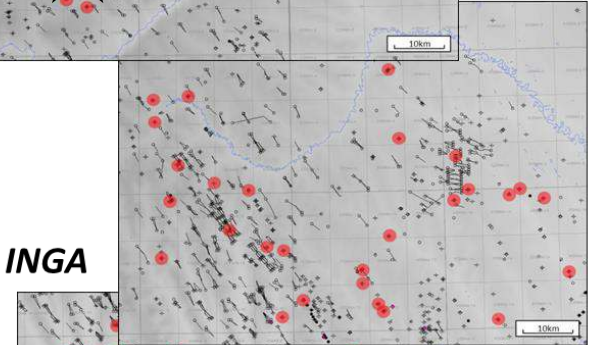




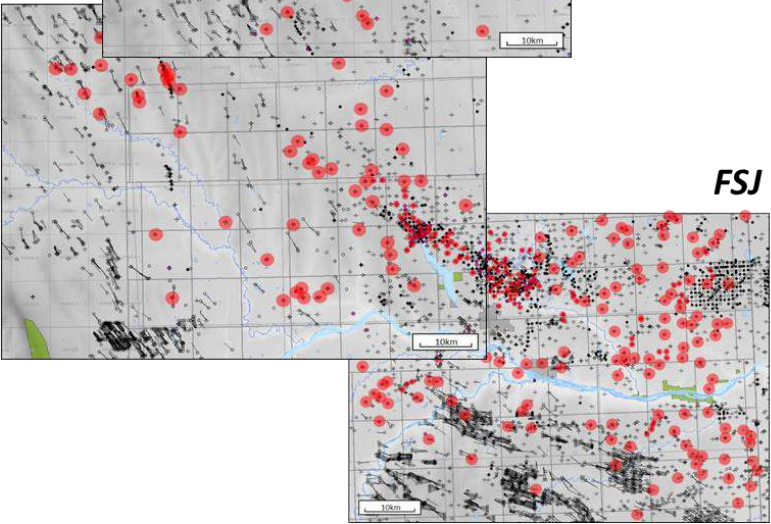
**CARIBOU**



**UMBACH**



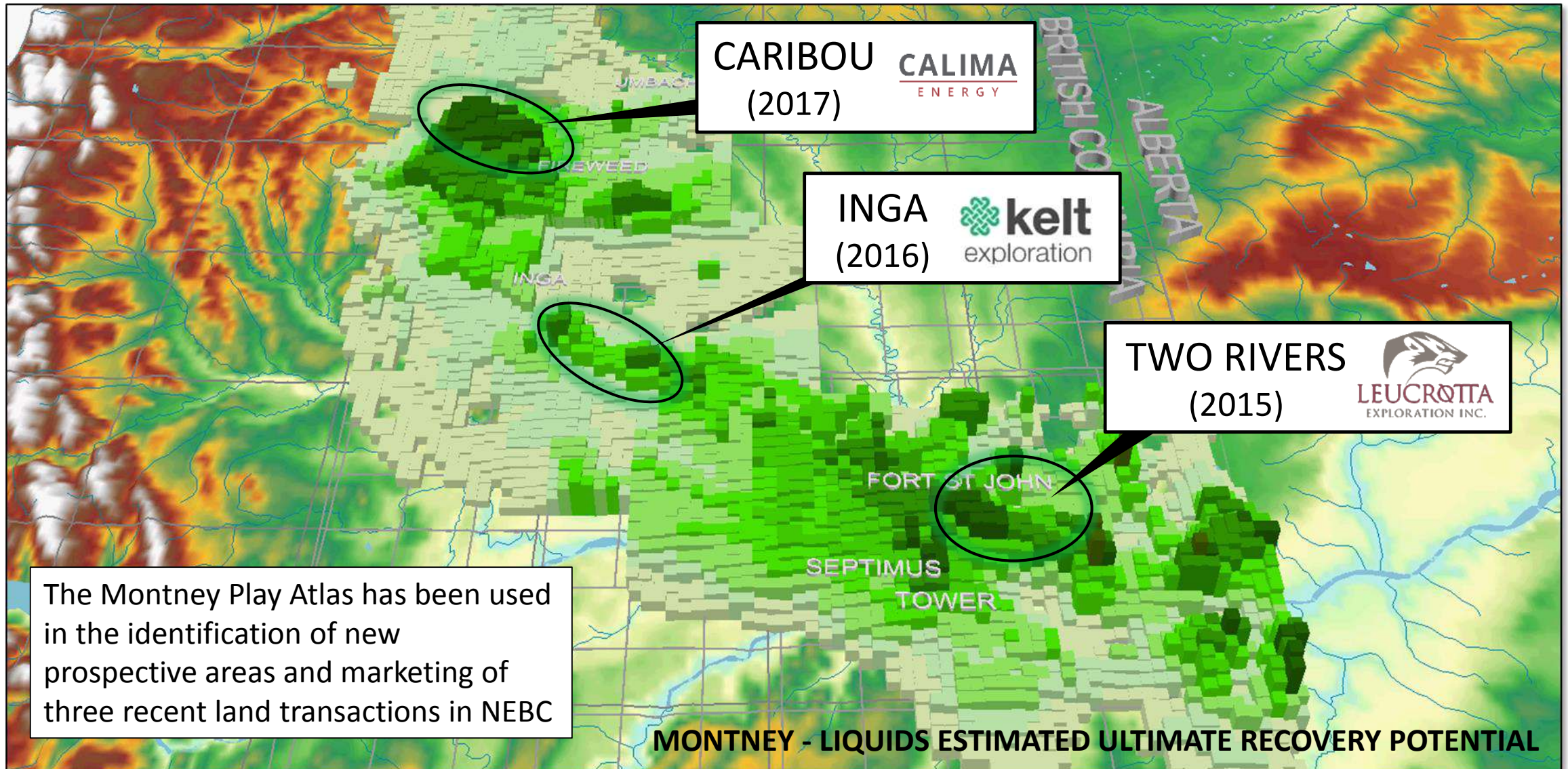
**INGA**



**FSJ**

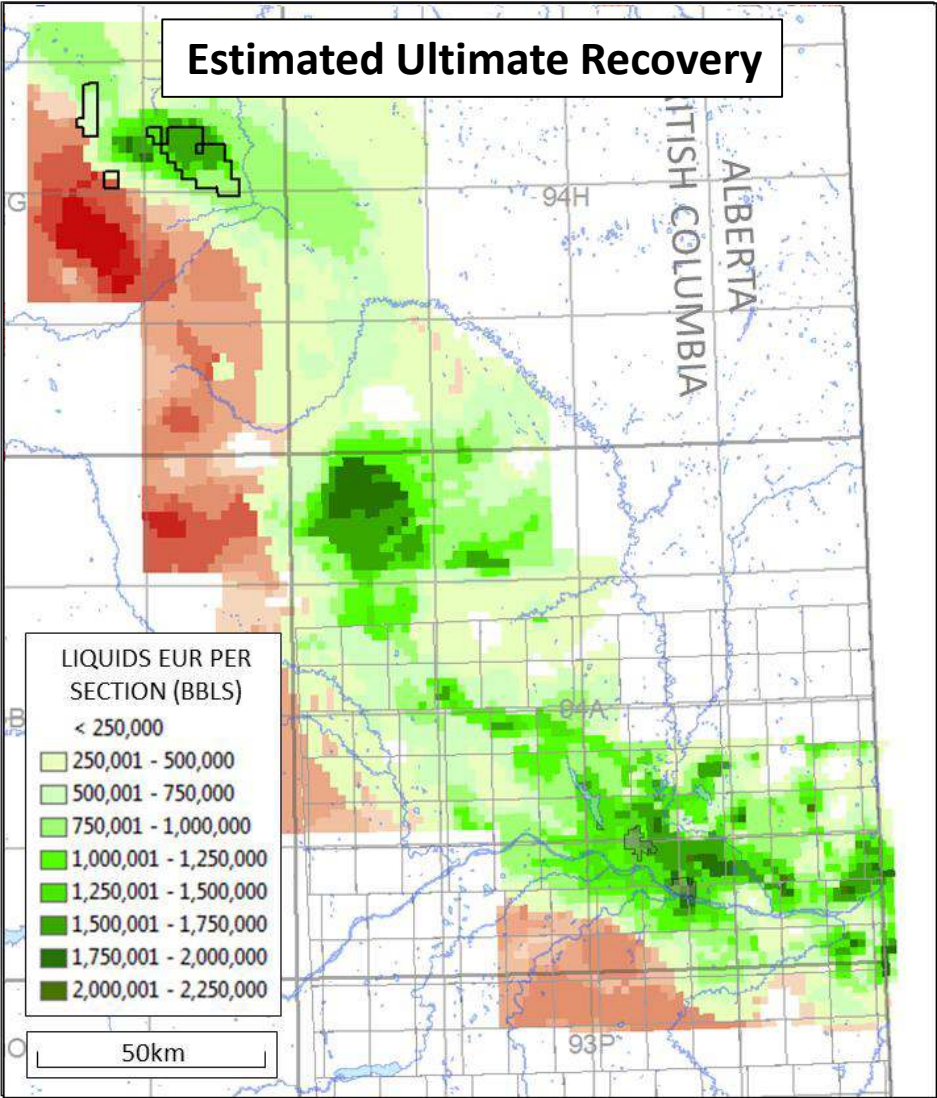


# Finding and quantifying liquids-rich sweet-spots

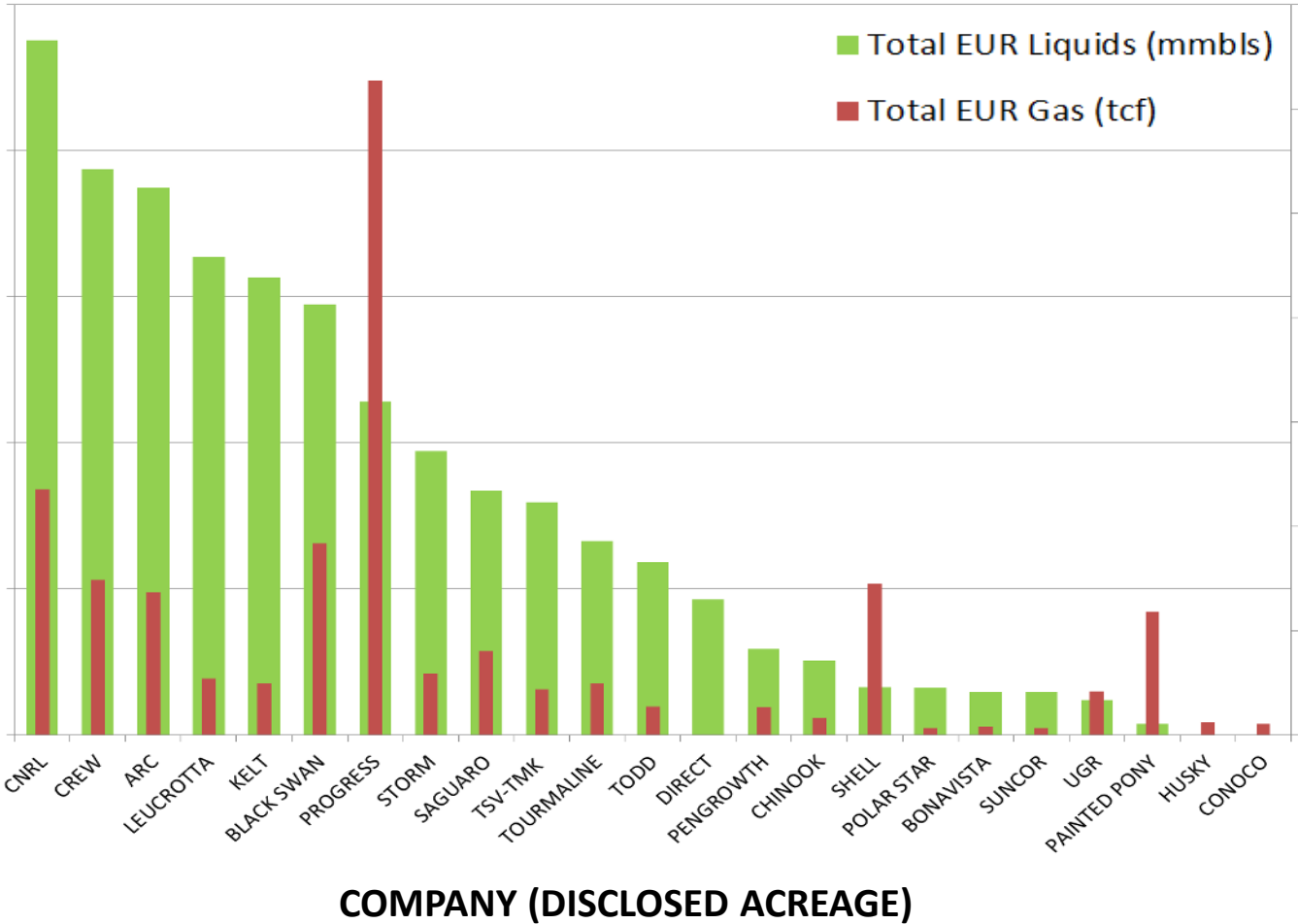




# Montney EUR per Company

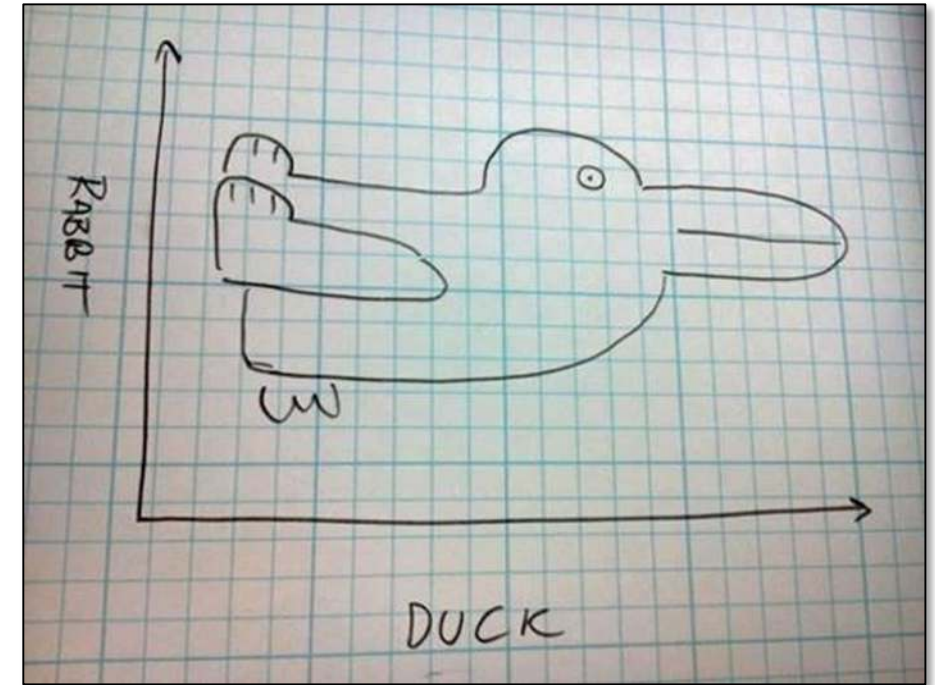


Montney EUR per Company



- Heterogeneity in unconventional opportunities can be seen at a global scale through to a play scale. Heterogeneity sets up the opportunity. There are winners and losers
- Not all Montney is Created Equal. Understanding the heterogeneity is key.
- Detailed petrophysical interpretation, spatial analysis, and an approach to calibrate production to Common Risk Segment Mapping has been used to identify sweet-spots and quantify recovery potential across the NEBC Montney at a section level detail
- Access to the interpretation product and results is available through purchase or subscription to the Montney Play Atlas

**Opportunities are created by those who see things differently**



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