

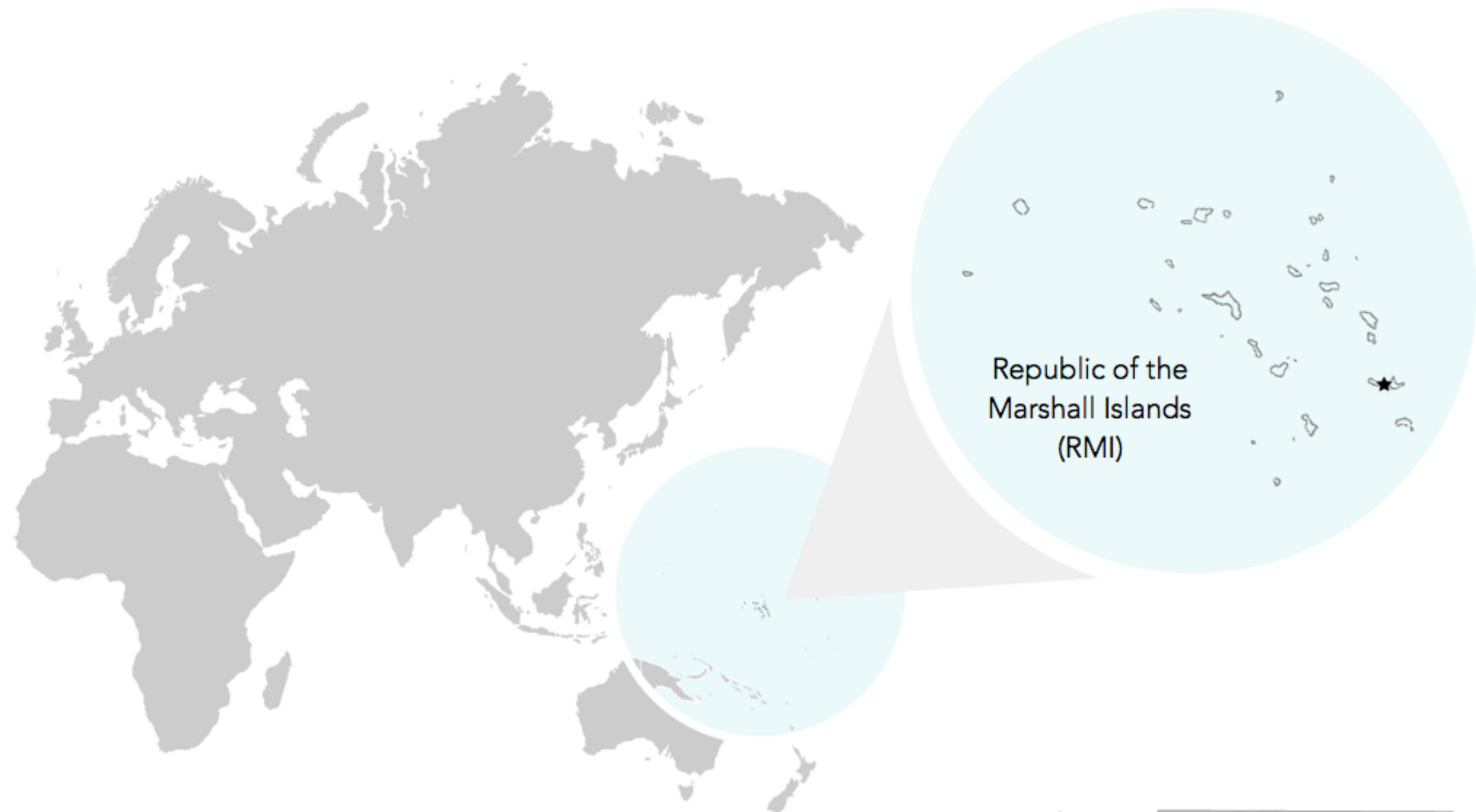
Miami Beach, Florida
King Tide
November 2016



UNDERSTANDING THE ROLE OF **CLIMATE CHANGE** AND **ECOSYSTEM SERVICES** IN THE **MIGRATION DECISIONS** OF MARSHALL ISLANDERS, AND THE **IMPACTS OF MIGRATION** IN **SOURCE AND DESTINATION AREAS**



William S. Richardson School of Law, University of Hawai'i | NOAA's Pacific Regional Integrated Sciences and Assessments (Pacific RISA) | Pacific Island Climate Science Center | Marshall Island Conservation Society



"THE GRAVEST EFFECTS OF CLIMATE CHANGE MAY BE THOSE ON HUMAN MIGRATION AS MILLIONS ARE DISPLACED BY SHORELINE EROSION, COASTAL FLOODING AND SEVERE DROUGHT" IPCC





Ballistic Missile Defense Test Site, Kwajalein



State of Environmental Conditions in Hawaii and the U.S. Affiliated Pacific Islands under a Changing Climate: 2017



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5. Sea Level

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Takeaways

- Since the early 1990s, global mean sea level (GMSL) has been rising at a rate of about 3.3 mm (0.13 in) per year. This is twice the estimated rate for the 20th century as a whole.
- Sea level has also been rising across the Pacific Islands region. However, regional and local sea level trends may differ significantly from the globally averaged rate over multiyear to multidecadal time scales. For example, local rates of change since the early 1990s are as low as 1.1 mm (0.43 in) per year at the Honolulu tide gauge and as high as 5.4 mm (0.21 in) per year at the Kwajalein tide gauge.
- Natural patterns of variability play an important role in regional and local variation in sea level. Compared to the central Pacific, in the tropical western and South Pacific these interannual and multidecadal changes can be quite large. In Guam, for example, ENSO-related variations in sea level are on the order of 30 cm (12 in).
- These natural patterns of variability can make it difficult to discern a reliable local long-term trend in shorter (less than 50 years long) records. In addition, vertical land motion due to earthquakes or subsidence further impedes the calculation of reliable trends.
- Small increases in the magnitude of sea level have resulted in dramatic increases in the frequency of minor flooding. At the Kwajalein tide gauge for example, high water events that occurred less than once a year, on average, in the 1960s occurred 22 times a year, on average, during the decade starting in 2005. Though with a considerably lower increase, at the Honolulu tide gauge minor flood frequency almost doubled during this same period, going from 6 to 11 times a year on average.
- Models suggest that global warming will raise global sea level significantly over the course of this century. Higher likelihood projections of GMSL call for a rise by 2050 equivalent to roughly double the current rate. By 2100 a rise of 0.5 m (1.6 feet) in GMSL is very likely and a rise greater than 2.0 m (6.6 feet) is plausible. Projections for sea level rise in Hawaii and other tropical Pacific islands call for an additional 20%–30% above the global mean.
- Increasing mean water levels means an increased potential for coastal flooding and erosion, as high waves ride the rising seas and threaten built and natural environments on all islands in the Pacific region.

On 3 March 2014, high tides combined with high waves causing the sea to sweep across portions of Majuro Atoll, in the Republic of the Marshall Islands (RMI), forcing almost 1000 residents to leave their homes. Coastal flooding takes many forms, ranging from major flooding associated with strong winds, high seas, and heavy rains during storms to minor flooding that occurs when exceptionally high tides combine with

high waves and other oceanic and atmospheric phenomena on storm-free days. There is growing recognition that the frequency of such minor coastal flooding events will increase dramatically with rising sea levels.^{1,2,3}



Source Kori Fellenius

Why should we care?

Sea level is an important indicator of climate change and variability. Changes in mean sea level are indicative of overall warming of the ocean and melting of ice on land. Rising sea levels increase the potential for coastal flooding and erosion which can have significant economic, social, and environmental costs.

Where are we now?

Global Sea Level

Global mean sea level (GMSL) has risen by about 20 cm (8 in) over the past 100 years (Figure 5.1). As of December 2016, the rate of GMSL rise measured by satellite altimeters since 1993 is 3.28 mm (0.129 in) per year (Figure 5.2). This recent rate reflects roughly a doubling of the rate that was observed over the 20th century based on tide-gauge reconstructions.^{4,5,6} This rise in GMSL can be attributed to an increase in the volume of water in the ocean due primarily to global warming. Heating of the ocean subsurface causes the water to become less dense and expand, whereas melting of glaciers and ice sheets transfer water mass from the land to the ocean. Changes in storage of water on land (e.g. lakes and reservoirs) can also affect sea level.

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Source Karl Fellenius



NUMBERS OF MARSHALLESE RESIDING IN THE
U.S. HAVE RAPIDLY RISEN OVER THE PAST TWO
DECADES, FROM 7,000 IN 2000 TO 22,000 IN 2010

CENTRAL QUESTIONS

1. TO WHAT EXTENT ARE **CLIMATIC STRESSORS**, AND THEIR IMPACTS ON **ECOSYSTEMS, LIVELIHOODS AND HABITABILITY**, ALREADY **DRIVING** MIGRATION IN RMI?
2. WHAT ARE THE **IMPACTS** OF MIGRATION IN **SOURCE** AND **DESTINATIONS** AREAS?
3. HOW DO **MIGRATION REASONS** AND **CONSEQUENCES** VARY AMONG DIFFERENT '**CLUSTERS**' OF RESPONDENTS?

SOURCE STUDY SITES (N=200)



RMI (March-April 2017)

Majuro (capital)

Maloelap Atoll

Mejit Island

DESTINATION STUDY SITES (N=80)

HAWAI'I (JULY-AUG 2017)
OAHU
BIG ISLAND

CONTINENTAL US (NOV 2017)
OREGON
WASHINGTON



Participatory Research Approach (PRA)



A group of seven men are gathered around a table covered with a red and black patterned cloth, engaged in a Participatory Research Approach (PRA) session. The men are of various ages and are actively participating in the discussion. One man in a red shirt is pointing towards the table, while another in a grey shirt is leaning over, possibly writing or drawing. The table is cluttered with papers, sticky notes, a green cup, a pink cup, a white mug, and a small orange box. The room has large windows in the background, letting in bright sunlight. A black leather sofa is visible in the background on the right. The floor is made of light-colored tiles.

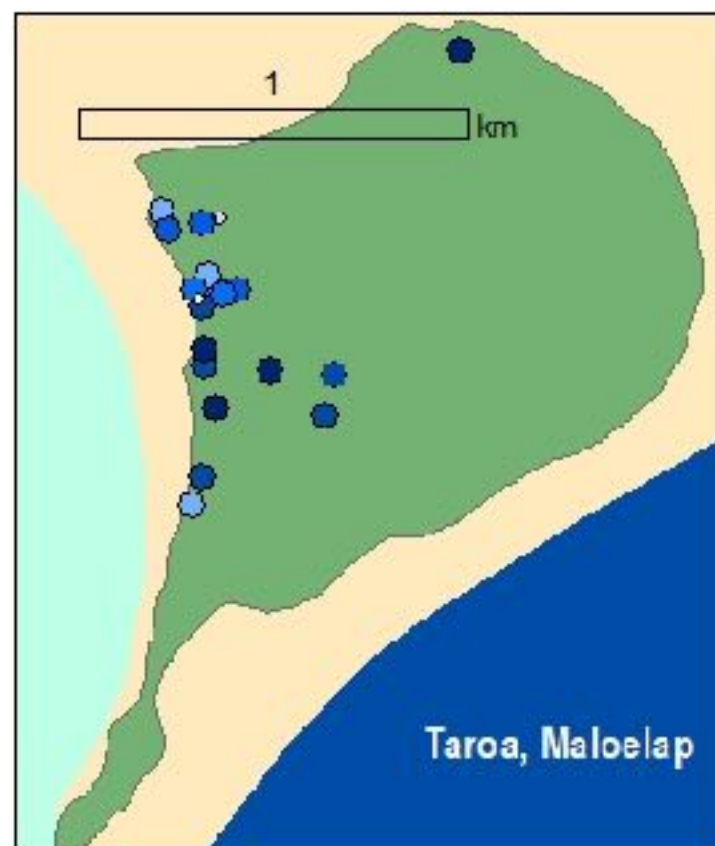
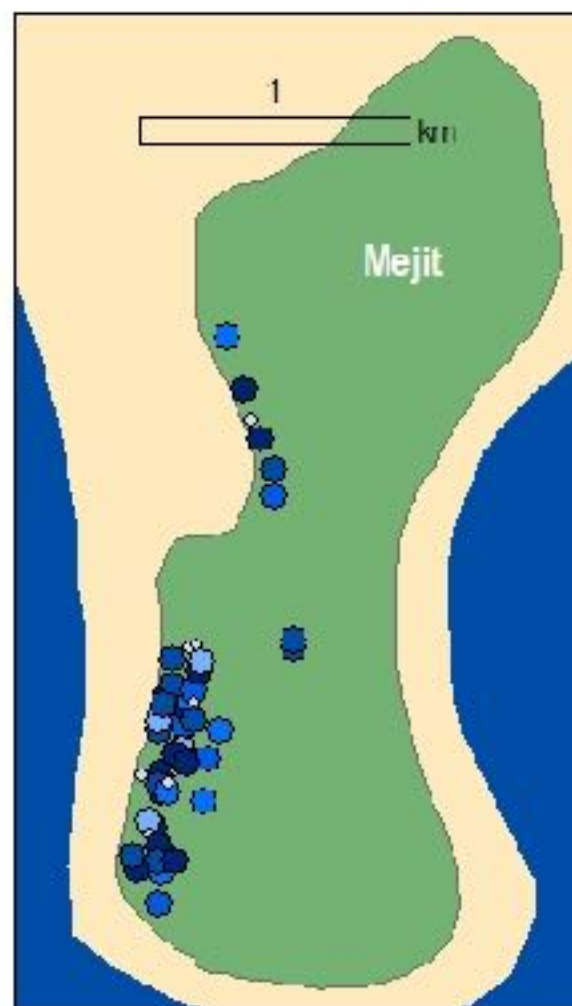




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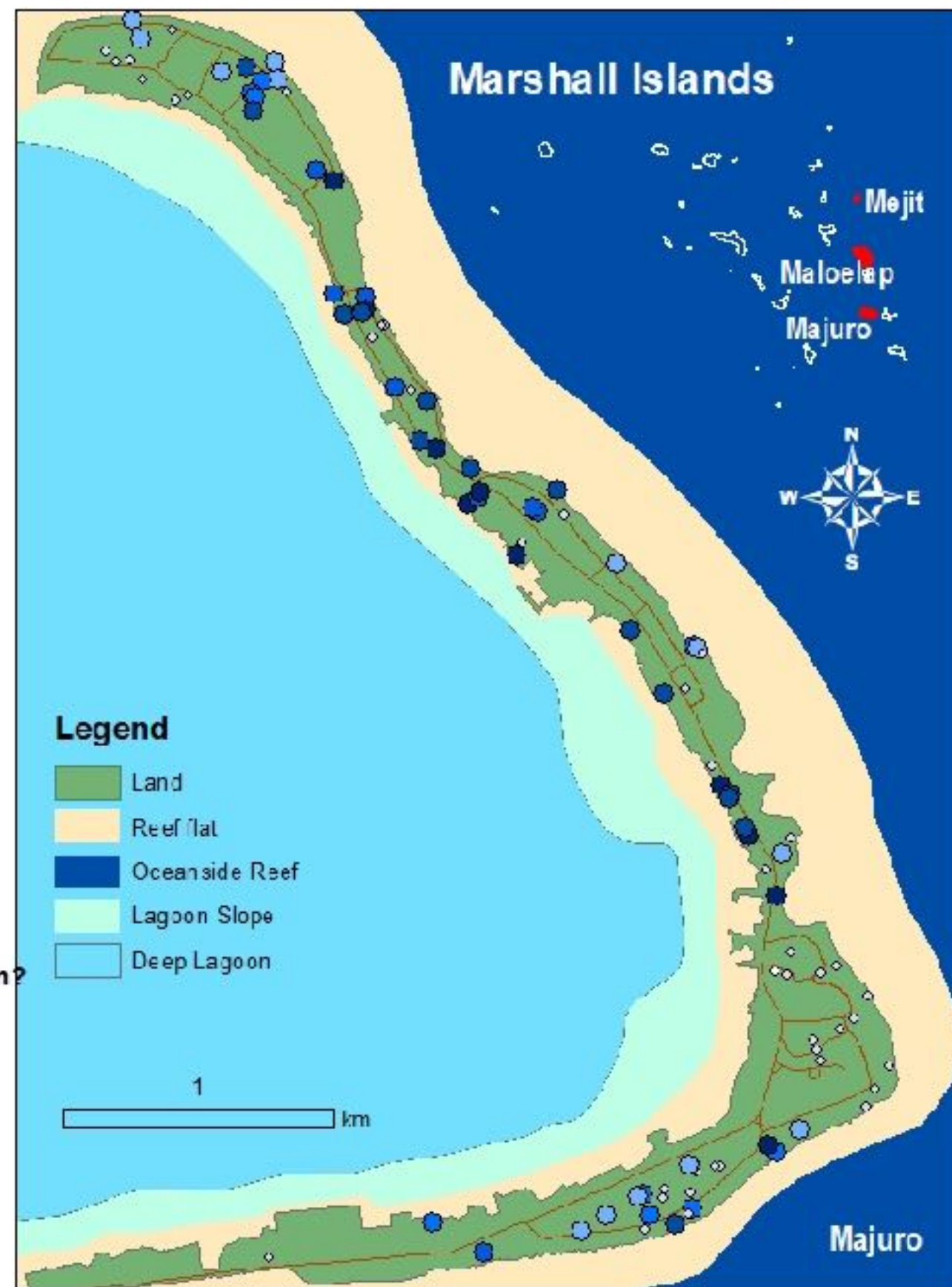
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Is Not Enough Freshwater a Problem?

- Most serious problem (10)
- Second most serious (14)
- Third most serious (8)
- Fourth most serious (9)
- Fifth most serious (13)
- Not a serious problem (11)
- No response given (1)

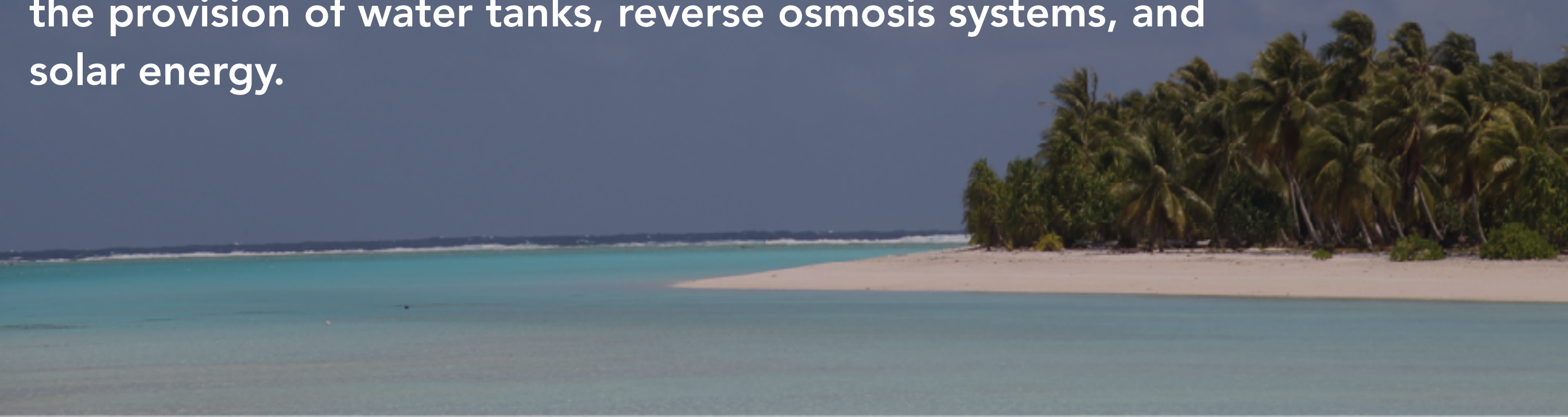


RMI FIELD WORK: PRELIMINARY RESULTS

Concerned about climate change and sea level rise, but more as a **future risk** than as an **acute current problem**.

Drought posed a bigger problem currently, affecting **health** and **agricultural productivity**.

Respondents on **outer islands** were 'unusually positive' about **external interventions** (by government and NGOs), especially **the provision of water tanks, reverse osmosis systems, and solar energy**.



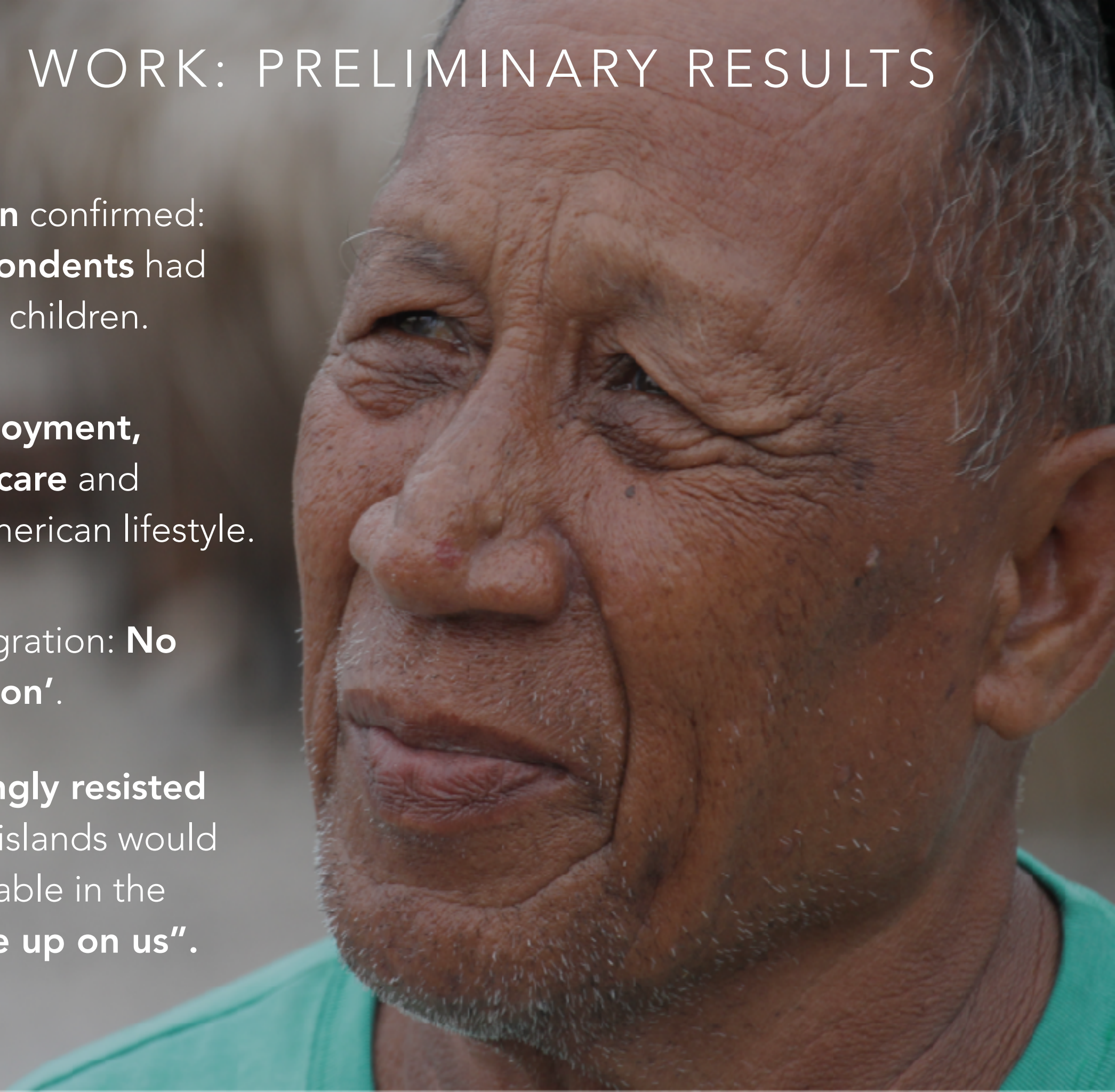
RMI FIELD WORK: PRELIMINARY RESULTS

High **out-migration** confirmed:
Over **95% of respondents** had
migrant siblings or children.

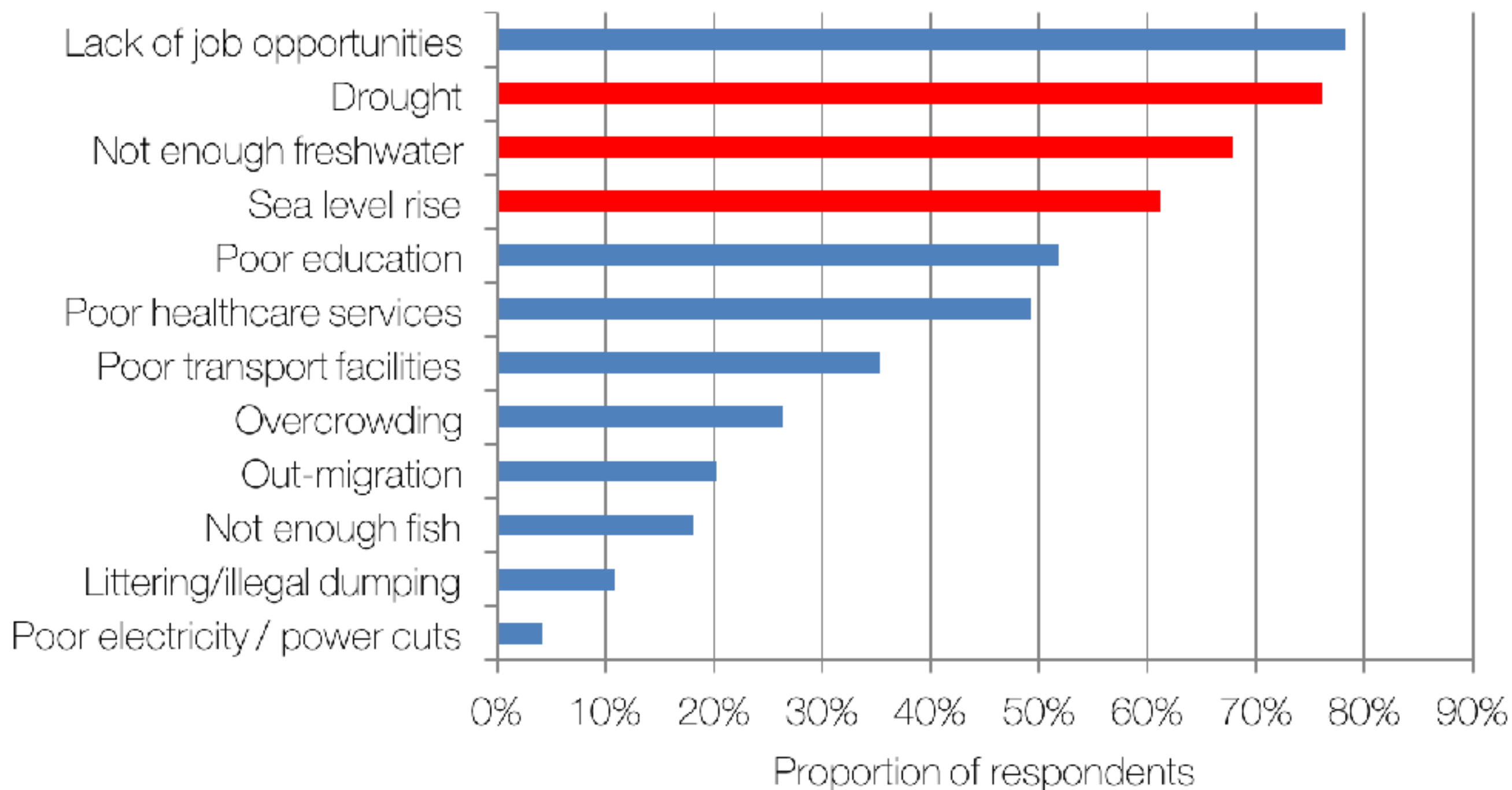
Main drivers: **employment,**
education, healthcare and
curiosity/pull of American lifestyle.

Low barriers to migration: **No**
'trapped population'.

Respondents **strongly resisted**
the idea that their islands would
become uninhabitable in the
future. **"Don't give up on us".**



Problem Ranking (N=200)

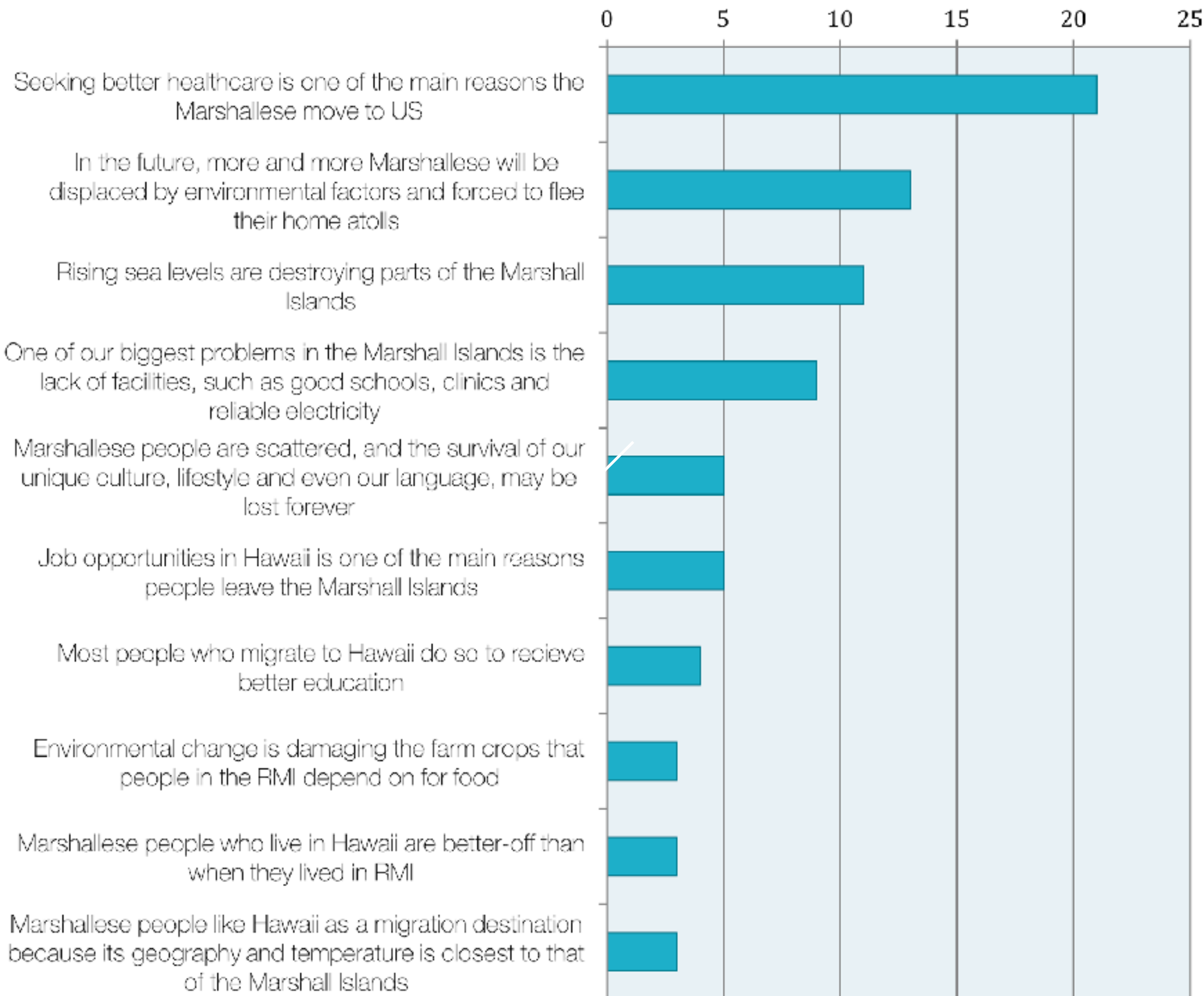


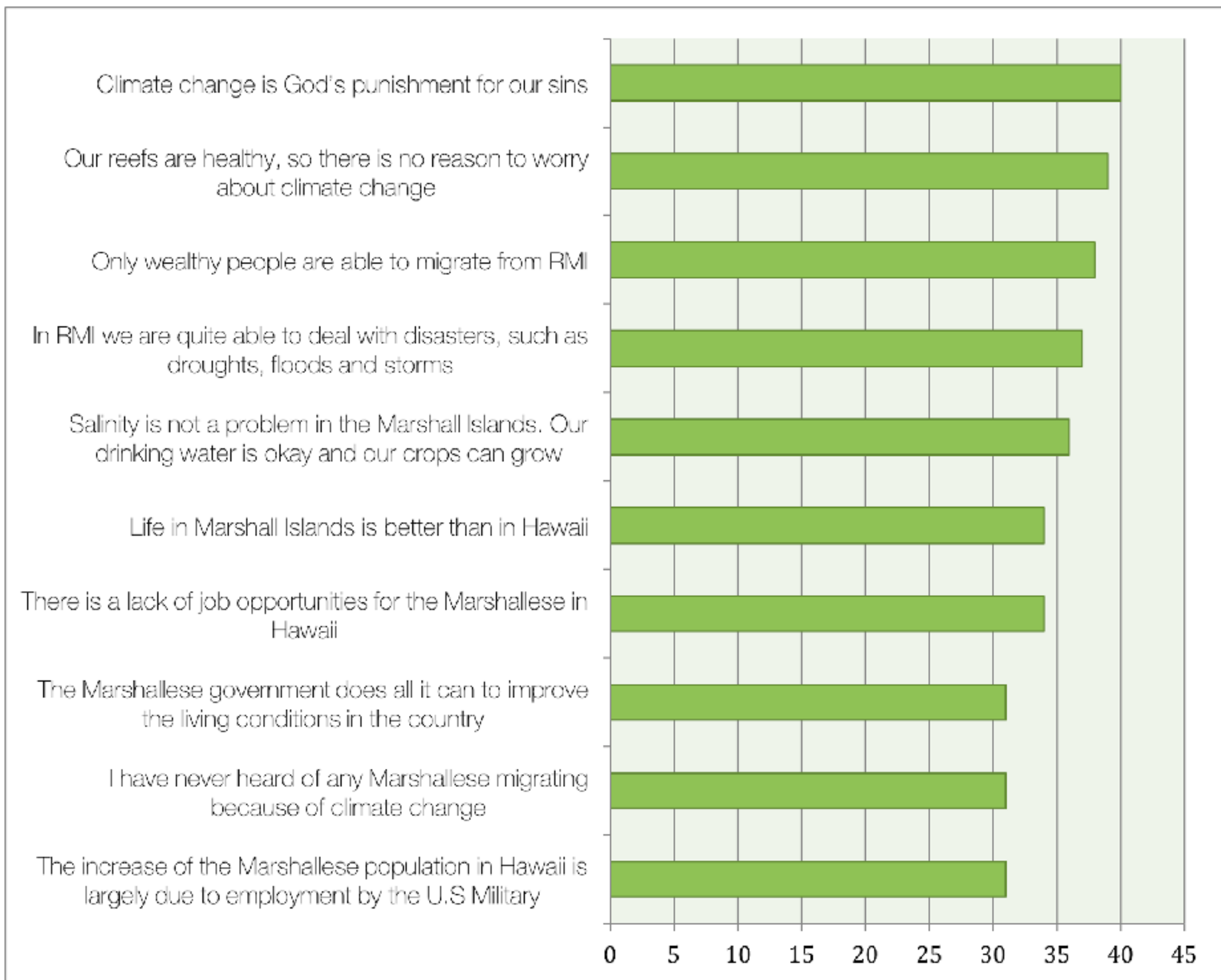


DESTINATION STATES

HAWAII & OREGON STUDY

TOP 10 'STRONGLY AGREE' STATEMENTS (HAWAII)





HAWAI'I & PACIFIC NORTHWEST: PRELIMINARY RESULTS

PERCEPTION OF CLIMATE CHANGE AND EXTREME EVENTS IN RMI

42.5 % : environmental factors
influenced decision to migrate to
Hawai'i/ Pacific NW

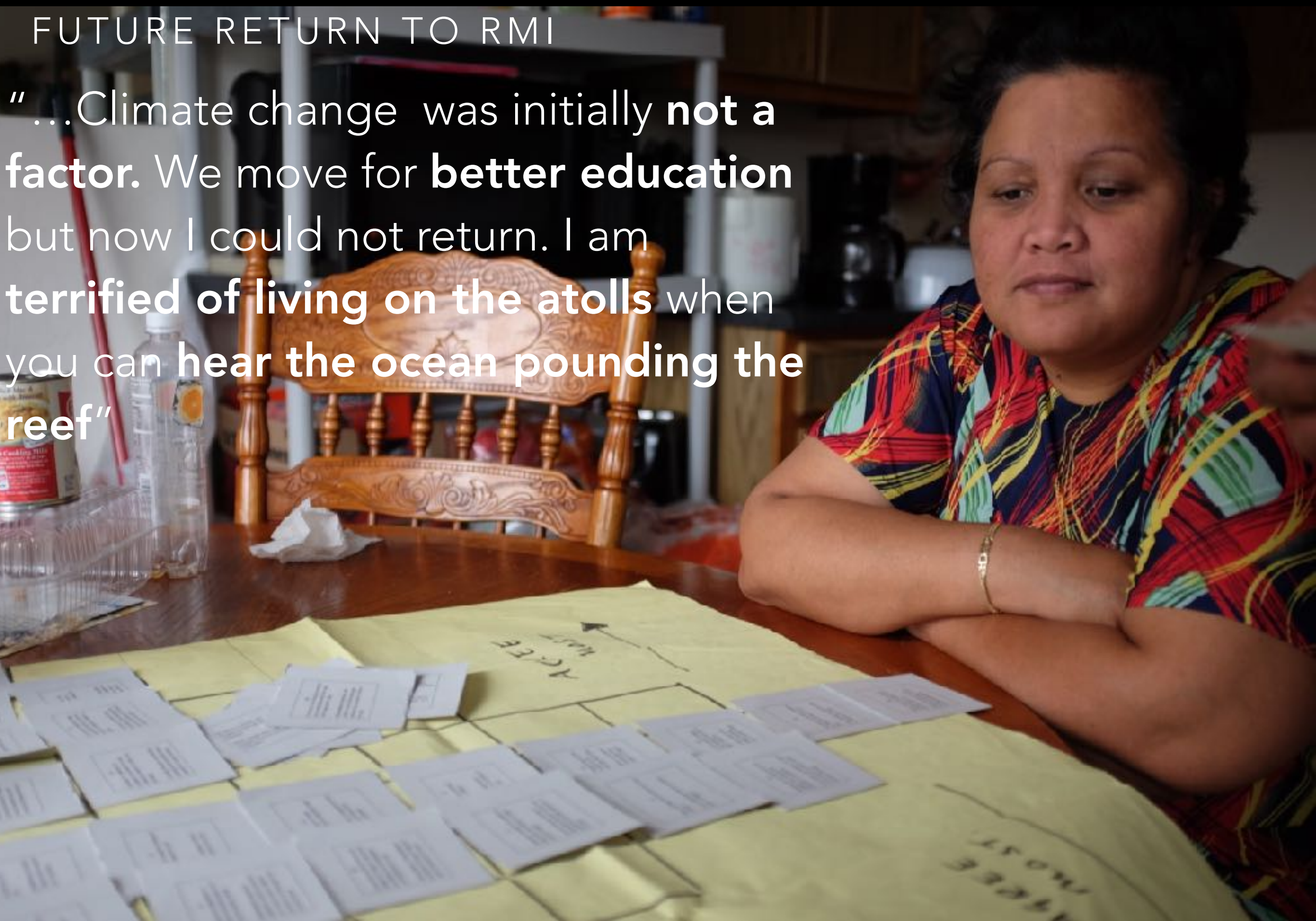
95% : **drought, king tides and heat waves** (severely increasing in the last 5-10 years)

Ocean pollution and ocean health

+ correlation: the **lack of access to drinkable water & climate induced migration**

PERCEPTION OF CLIMATE CHANGE AFFECTING FUTURE RETURN TO RMI

“...Climate change was initially **not a factor**. We move for **better education** but now I could not return. I am **terrified of living on the atolls** when you can **hear the ocean pounding the reef**”



A close-up photograph of a wire mesh trap, likely a crab trap, filled with discarded food cans and containers. The trap is made of dark, rusty metal wire. Inside, there are several green and yellow cans, some with labels, and other debris. The background is a light-colored, pebbly surface. The text is overlaid on the left side of the image.

“...**cultural preservation** is problematised by climate change. Is **returning** to a means of living that supports **farming, fishing and a healthy diet** possible in the face of a **vulnerable, salty environment**?”

STATE OF WELL-BEING / SUCCESSFUL MIGRATION

STATE OF WELL-BEING	RMI (home)	Hawaii (destination area)	Difference
Health care	1.9	4.1	2.2
Social services	1.8	3.7	1.9
Employment	2.3	3.9	1.6
Education	3.1	4.4	1.4
Food security	3.2	4.2	1.0
Safety	4.0	4.1	0.1
Purchasing Power	3.3	3.2	-0.2
Housing	4.3	3.4	-1.0

STATE OF WELL-BEING	RMI (home)	Oregon (destination area)	Difference
Employment	2.1	4.3	2.2
Health care	2.2	4.1	2.0
Social services	1.9	3.6	1.7
Education	3.1	4.6	1.5
Food security	2.8	4.2	1.3
Purchasing Power	3.0	3.6	0.6
Housing	3.8	3.7	-0.2
Safety	4.4	3.8	-0.6

RED indicates a negative change after migration.

GREEN indicates a positive change after migration



Jack Hall Housing Waipahu



Kaka'ako, Oahu

NEXT STEPS:

Information Sharing Workshops w/ RMI
Community

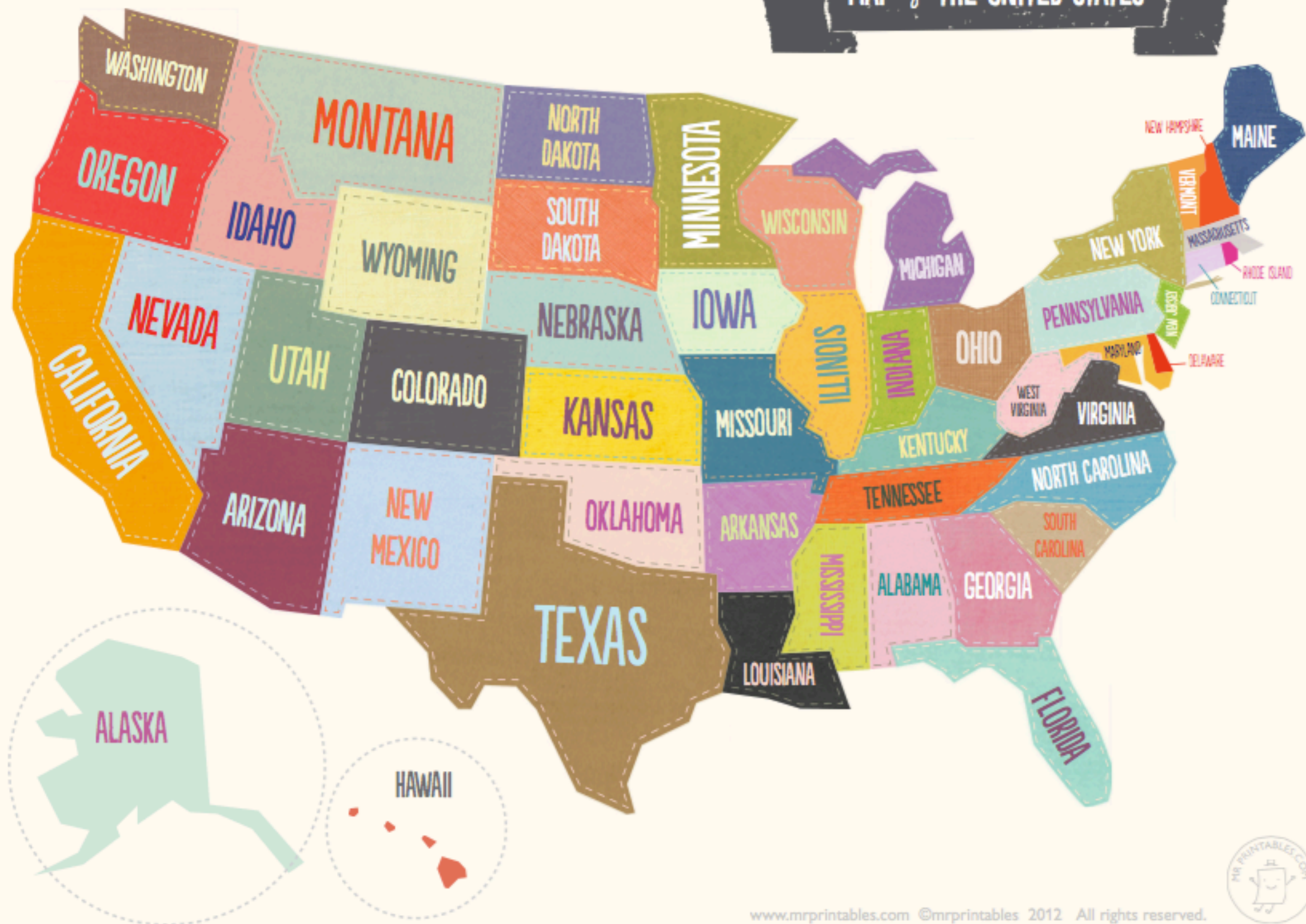
Maps: Correlation of HH Results and
Ecosystem Services & Vulnerability
Indices

Published results expected before
COP24

More information: www.rmi-migration.com



MAP of THE UNITED STATES



MAP of THE UNITED STATES



A dramatic sunset over a body of water. The sky is filled with vibrant orange, red, and yellow clouds, reflecting on the calm water. In the foreground, the silhouettes of palm trees and a few people sitting on a sandy beach are visible. The overall mood is serene yet powerful, suggesting a transition or a significant event.

*Behind the Veil:
Climate Migration, State Shift, and New Theories of Justice*

[Forthcoming __ HARV. C.R.-C.L. L. REV. __ (Spring 2018)]

Prof. Maxine Burkett

Credit: David Gray/Reuters