nuveen
NATURAL CAPITAL

How Nuveen identifies and evaluates farmland suitable for institutional investment

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SUMMARY

Nuveen's farmland manager was founded in 1986 and currently manages more than two million acres scattered over four continents. This long history and significant management area has afforded us unique insights into farmland suitable for institutional investment. We remain a strong proponent of the notion that a globally diversified portfolio is the best way to invest in farmland assets. Geographic diversification, when properly executed, can mitigate the effects of external local risk factors such as adverse weather and price volatility.

To execute geographic diversification effectively, one must first source the farmland opportunities in their respective global locations. Therein lies the question – how does Nuveen determine which countries and regions are investable? This paper examines the availability of farmland globally in acres. We outline the process we undertake to analyze and filter the world's available farmland down to an investable universe that is suited for institutional investment. Finally, we outline the methodology by which we estimate the value of this investable universe.

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There are approximately 11.8 billion acres of agricultural land worldwide."

## THE UNREFINED GLOBAL AGRICULTURAL LANDSCAPE

According to the United Nations Food and Agriculture Organization's (UNFAO) 2018 Land Use data, there are approximately 11.8 billion acres of agricultural land worldwide. Agricultural land is comprised of pastureland that livestock are reared on and arable farmland where crops are grown. Exhibit 1 shows that pastureland constitutes 67% of global agricultural land, or approximately 8 billion acres, while cropland occupies the balance of 3.8 billion acres.

The focus of this report is to survey the global agricultural landscape in terms of cropland, and identify which countries have the potential for institutional investment. Pastureland was omitted from this analysis as it requires large capital investment into livestock and infrastructure, resulting in a more volatile return profile than farmland with potentially higher environmental risks. As with any investment, not all jurisdictions

Exhibit 1: Global agricultural land breakdown: 11.8 billion acres

● Cropland
● Pastureland

32.7

67.3

Source: UNFAO, 2018.
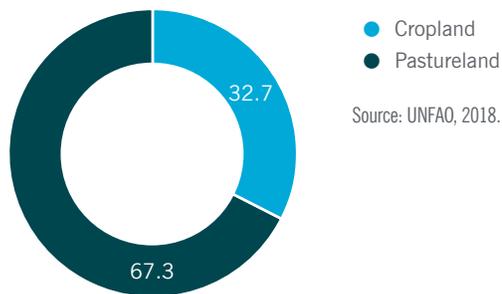
present a compelling case and deliver the necessary risk adjusted returns. Several factors require examination at the macro and micro level when identifying geographies for investment. To better describe the examination process from the FAO farmland population to the investable universe, we've divided the macro and micro considerations into two rounds of filters.

MACRO FILTER – A TOP DOWN FILTER ON SUITABLE GEOGRAPHIES

The key factors we use to identify prospective investment farmland geographies include regulatory environment, political environment, production advantages, comparative export advantages, crop diversification, and the extent of implemented technology. The analysis of these variables involves detailed due diligence executed on each identified country with a sufficient scale of arable farmland.

The first consideration is to determine if a country's regulatory and political environment is conducive to foreign ownership of farmland. Several countries and even regions have varying degrees of restrictions on foreign or corporate ownership of farmland. Some may be absolutely restrictive, which makes investment of scale infeasible, as is the case in Canada, Argentina, Russia and certain states in the U.S. Other countries may not be restricted, but may have regulations that add costs to investment ownership, such as requiring the establishment of a domestic entity to hold the assets' title. Such costs impact returns, making

them less attractive relative to geographies that do not have cost bearing regulations. Fully understanding the regulatory environment as it relates to foreign ownership of farmland is critically important to making an initial investment and growing a footprint over time.

In addition to ownership restrictions, the overall political stability should be taken into consideration, as with any investment in a foreign country. All countries present some degree of political risk, but in certain markets politics can impact the underlying currency and in turn increase the volatility of farmland investment returns. Several countries in Latin America and Africa are endowed with arable land and other natural resources that are attractive from an agronomic point of view. Yet a deeper analysis into the sociopolitical aspects of a country and the potential impact on a farmland investment, reveal many areas where the inherent risks are too high to warrant such a venture. While it could be a viable investment country in the future, Argentina is a good example of a strong agricultural country with outsized political risks. There are large amounts of fertile land, the agricultural value chain is well developed and producers utilize a wide range of technologies, but the push and pull of politics, manifested in protectionist trade policy and volatile currency, is anticipated to result in more volatile investment returns, muting the appetite of foreign investors.

Almost every country in the world is engaged in some form of agricultural production; however, certain geographies exhibit agronomic characteristics that make them more compelling for investment. It is necessary to evaluate a country or region's productivity and cost of production for specific crops to gauge agricultural performance over the long term. Regions with high agricultural output can attribute much of their productivity to quality soils, sufficient water, and weather patterns conducive to growing certain crops. For example, due to its unique microclimate and broad area, California's Central Valley is responsible for over 80% of the world's almond production. Identifying geographies with production advantages allows an investor to diversify by region and crop type to mitigate risk and augment returns.
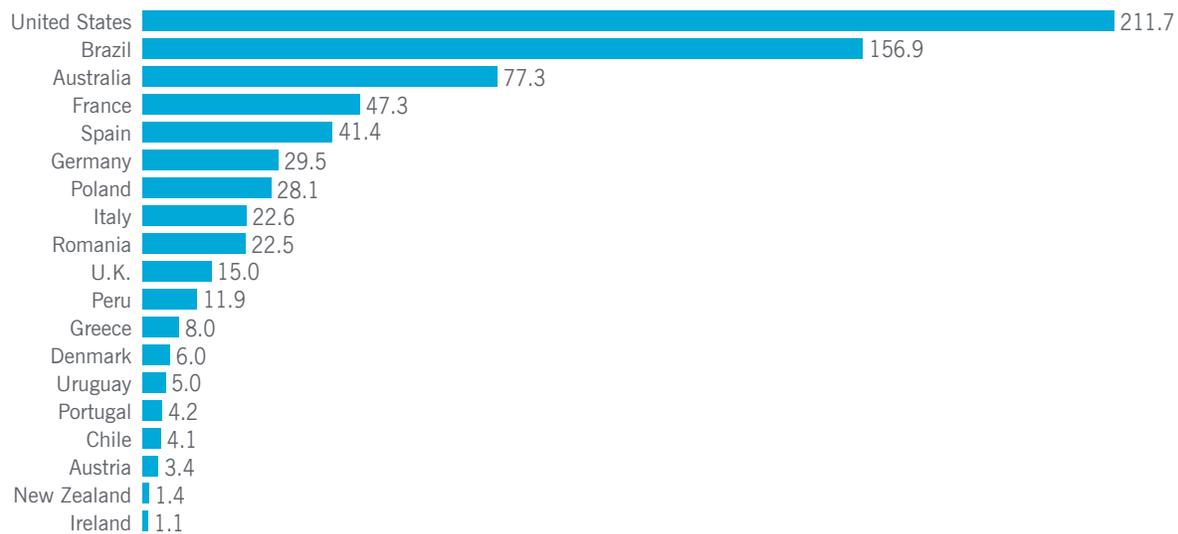
Another consideration is a country's export capacity. Countries that are net exporters of agricultural goods often enjoy comparative advantages in production, i.e. low input costs, favorable trade agreements or logistical benefits that add to the investment case. Natural resource endowments play a major role, but a country's population, domestic consumption patterns, location relative to trade partners and trade policy are also factors determining export volumes. When a country produces more of an agricultural commodity than it consumes, the balance is usually exported to the global market. Although trade surpluses vary over time due to the variable nature of agricultural production, overall, net agricultural exports are a good indicator that farmland investments within that country warrant consideration.

Crop diversity also contributes to the attractiveness of a geography for investment. If a certain geography produces a variety of crops with low or even negative correlation to other crop types, an investor is able to mitigate blight risks and pricing risks associated with a certain commodity. Brazil, for example, produces a number of annual crops such as soybeans, cotton and sugar as well as permanent crops like coffee and citrus due to the country's size and diversity of microclimates.

Utilization of technology among local producers can play a role in identifying a prospective geography. Comparatively, this is a smaller factor than natural resources, export trade, and crop diversity, but it is a telling sign of competitive advantages and creates an expectation for productivity increases over time. When productivity gains are achieved, that value can be capitalized into the land the crop is produced on and augment returns, all else constant. In addition, producers who are adopters of new technology are also generally looking to expand their area under cultivation via various structures including leasing land and indicates the potential for a strong tenant pool for a farmland owner. Evaluating the use of technology in agricultural production systems within a country provides insight into the potential tenant base and if their practices add value over time.

Once the above macro considerations have been evaluated, the aggregate farmland area conducive for institutional investment globally becomes more apparent. As demonstrated in Exhibit 2, the size of a theoretical investable land area narrows significantly from the global totals to 697 million acres across 19 countries, emphasizing the winnowing effects the macro considerations have on the FAO farmland population.

Exhibit 2: Theoretically investable farmland geographies: 697 million acres

Country	Acres (millions)
United States	211.7
Brazil	156.9
Australia	77.3
France	47.3
Spain	41.4
Germany	29.5
Poland	28.1
Italy	22.6
Romania	22.5
U.K.	15.0
Peru	11.9
Greece	8.0
Denmark	6.0
Uruguay	5.0
Portugal	4.2
Chile	4.1
Austria	3.4
New Zealand	1.4
Ireland	1.1

Source: UNFAO, 2018.

MICRO FILTER – A BOTTOM-UP FILTER ON FARMLAND

To further refine the investible universe, considerations shift from macro to microeconomic themes. These considerations include farmland returns, the scalability of investment, infrastructure, and environmental and social considerations.

The return profile of specific geographies and crop types play the largest role in evaluating agricultural area for farmland investment. Local returns must be sufficient to overcome risks and expenditures revealed in the macroeconomic considerations. We leverage extensive local knowledge to model expected returns of potential farmland investments, accounting for productivity factors, crop mix, local markets, taxes, transportation costs as well as necessary capital expenditures and maintenance costs.
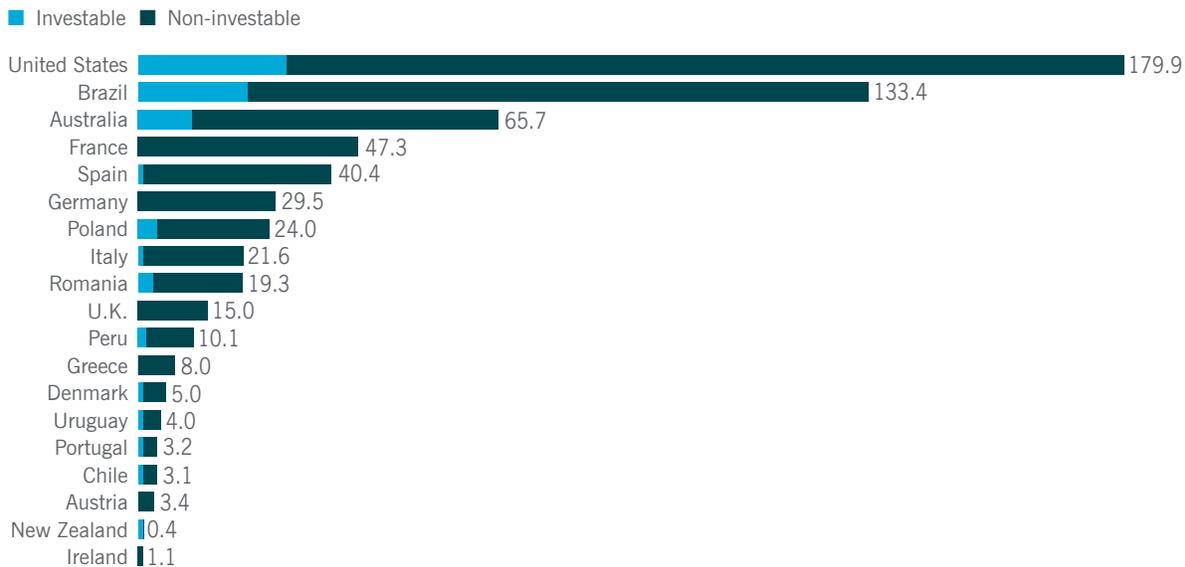
When investing in a country, achieving an efficient scale of operations is critical to the viability of returns. Farmland must be managed locally, requiring some extent of management resources in the geography one chooses to invest in. Such management resources are easily scalable, spreading an effective fixed cost over a sufficient scale of farmland investment and thereby lowering both the average and incremental cost to manage.

Existing and planned infrastructure is also an important consideration when evaluating farmland. Well-built roads and rail networks have an impact on farmland values and the efficiency of agricultural operations. Reliably accessing a piece of farmland with machinery is critical to growing and harvesting crops. Additional factors to understand include distance to the nearest market, the number of local buyers, prevalence of railroads or rivers to transport products, processing facilities, and adequate cold storage for fruits and vegetables. Without this infrastructure, the long-term investment returns may suffer.

Environmental considerations are playing an increasingly important role. Environmental concerns can arise in the form of government regulation, consumer demand, the assessment and impact of climate change, or simply the consciousness of the landowner. For example, environmental regulations from governments can take the form of pesticide bans, water use restrictions, or restricting land use change, all of which can decrease the relative competitiveness of production by increasing costs. Water use management in California's Central Valley is a prime example of this, as recent regulations have decreased access to groundwater there, reducing productive capacity and negatively affecting land values of certain farms. We conduct detailed analysis on water availability, water sources and go-forward water pricing and this ultimately restricts investments in water challenged areas.

By using our proprietary expected return data and research on all of the targeted geographies and regions, we continued to filter out countries that would not meet the return, scale, infrastructure and/or environmental requisites. Even after arriving at a list of currently investable countries and their gross acreages, another filter is still required. Our extensive experience evaluating deals across different geographies, crop types and operating strategies has shown that the microeconomic factors above continue to narrow down what is institutional grade farmland even within a country or region considered attractive for investment. Based on this experience, we have determined that 15% of the farmland acreage in currently investable countries is fit for inclusion in an institutional portfolio. The result of this work demonstrates that our current investable universe consists of approximately 83 million acres across 13 countries, as seen in Exhibit 3. To further understand the farmland content of this universe, we have formulated a consistent methodology to estimate its monetary value.

Exhibit 3: Nuveen's current investable farmland universe: 83 million acres

■ Investable ■ Non-investable

United States	179.9
Brazil	133.4
Australia	65.7
France	47.3
Spain	40.4
Germany	29.5
Poland	24.0
Italy	21.6
Romania	19.3
U.K.	15.0
Peru	10.1
Greece	8.0
Denmark	5.0
Uruguay	4.0
Portugal	3.2
Chile	3.1
Austria	3.4
New Zealand	0.4
Ireland	1.1

Source: Nuveen analysis, 2020.

ESTIMATING THE MONETARY VALUE OF THE INVESTABLE FARMLAND UNIVERSE

Establishing an estimated market size by monetary value allows Nuveen and our investors to understand the breadth and depth of the current investable farmland landscape. Approximating this market value is not an easy task as a variety of factors and assumptions are required to arrive at an estimated market size.

Once the investable universe was identified, we collected acreage data from the UNFAO data set, which breaks down acreage by row crop and permanent crop acres. This allowed us to evaluate the farmland data by the crop type produced. For example, a row crop property that grows corn and soybeans would be considerably lower in per acre value than a vineyard property with mature grapevines.
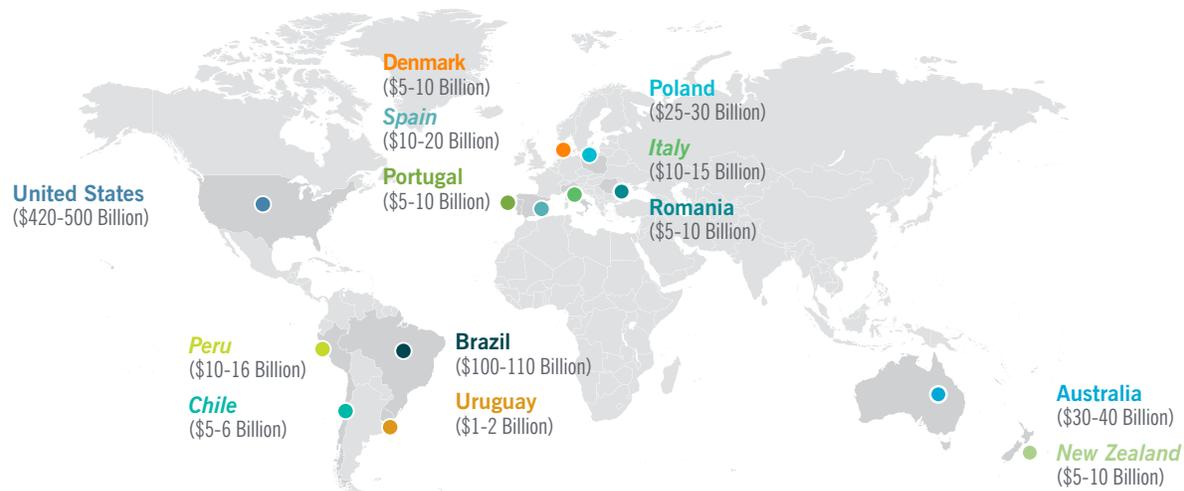
As a result of our experience in the industry and the magnitude of farmland acres under management, we have accrued an extensive database of farmland values. This database was leveraged to determine per acre values in each investible geography for permanent crop and row crop planted acres. While granular data on the particular crop grown on any given parcel of land is not available, assigning values to the local categories of permanent crops and row crops in any given geography rendered an improved estimate on per acre value. This resulted in an estimated market size for each geography and a total market size globally.

NUVEEN'S INVESTABLE FARMLAND UNIVERSE BY VALUE

After implementing the above methodology, we were able to approximate a current target market value, resulting in a size range between $600 and $700 billion. To add context, based on our current farmland assets under management, this would result in a current market share of roughly 1% of our current target market. Our current investable farmland geographies and their estimated market values can be seen in Exhibit 4.

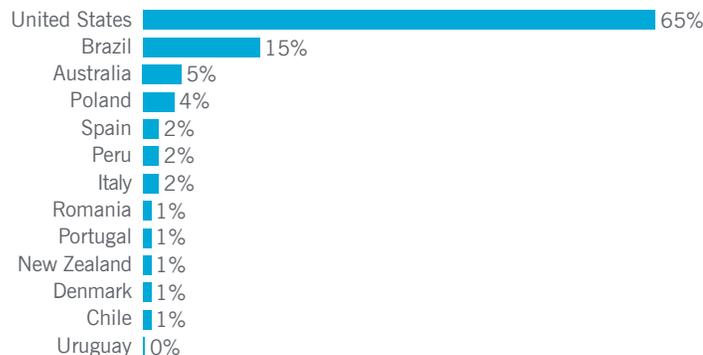**Exhibit 4: Nuveen's current investable farmland geographies and estimated market value**

Denmark
($5-10 Billion)
Spain
($10-20 Billion)
Portugal
($5-10 Billion)

Poland
($25-30 Billion)
Italy
($10-15 Billion)
Romania
($5-10 Billion)

United States
($420-500 Billion)

Peru
($10-16 Billion)
Chile
($5-6 Billion)

Brazil
($100-110 Billion)
Uruguay
($1-2 Billion)

Australia
($30-40 Billion)
New Zealand
($5-10 Billion)

Permanent crops only
Source: Nuveen analysis, 2020.

Based on our estimation, Nuveen's current target market is predominantly located in the U.S. We estimate the U.S. market for viable investments is $460 billion. That volume represents 65% of the estimated target market as shown in Exhibit 5. Our current global footprint has allowed strategic acquisitions in most geographies that are considered viable from a farmland investment standpoint. This analysis allows us to understand that there are still broad opportunities of investment quality farmland globally.

While this analysis allows us to approximate a market value, some shortcomings do exist that agricultural investors will have to account for when estimating the current market value of investment opportunities. This analysis represents a snapshot in time based on a myriad of both quantitative and qualitative factors. It is more than fair to assume that in five years certain factors may alter whether or not a geography or crop type is investable. Differing geopolitical events, shifting consumer demand, and changing weather patterns, to name few, will continue to alter our target market.

Exhibit 5: Breakdown of Nuveen's investable farmland geographies by market value

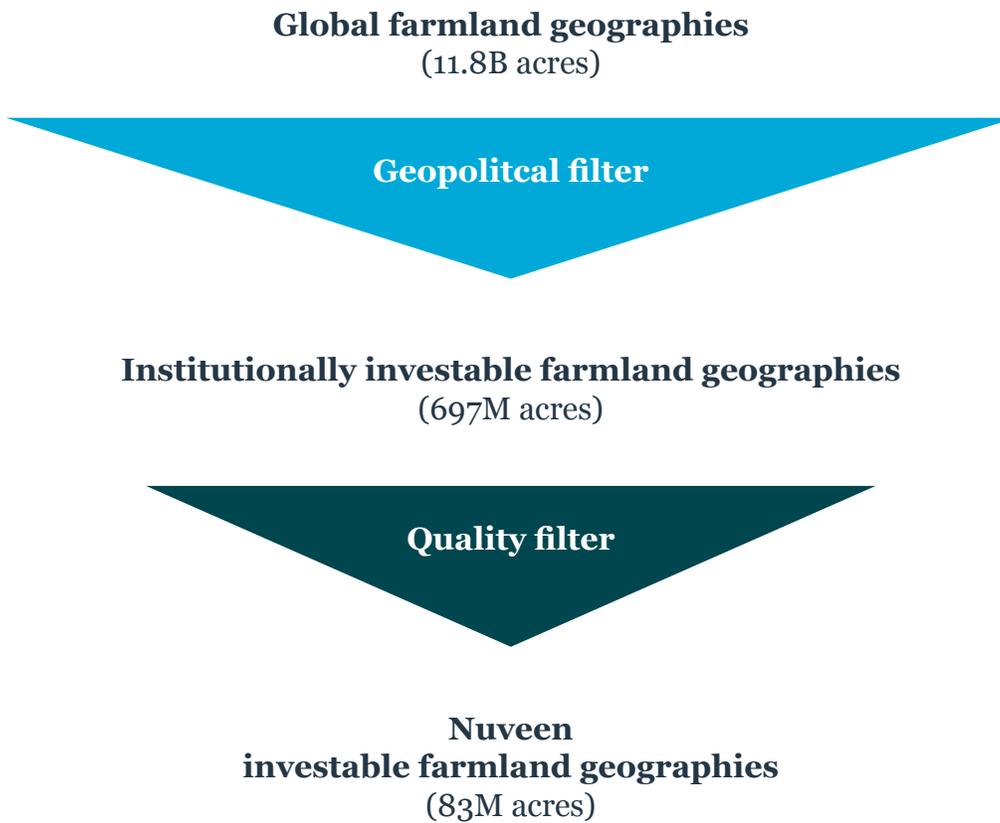|	
United States	65%
Brazil	15%
Australia	5%
Poland	4%
Spain	2%
Peru	2%
Italy	2%
Romania	1%
Portugal	1%
New Zealand	1%
Denmark	1%
Chile	1%
Uruguay	0%

Source: Nuveen analysis, 2020

Further, many agricultural investments are not simply comprised of a land acquisition that goes unimproved for the investment period. For example, investments may include capital expenditure opportunities like developing irrigation or adding grain storage, adding value to the property and increasing capacity for investment dollars. These types of development scenarios were not considered for this market estimate exercise and would otherwise result in a higher value than the current estimate.

The estimated market size in this paper is a strong indicator of potential investment opportunities for cropland. A conservative approach was taken to narrow down the investable universe and evaluate the target market size and ensure a desired level of quality was achieved. A summary of this process may be referenced in Exhibit 6. This methodology should result in a more accurate market size than simply using the value of gross farm acreage in each geography.

Exhibit 6: Nuveen's investable farmland universe process

Global farmland geographies
(11.8B acres)

Geopolitcal filter

Institutionally investable farmland geographies
(697M acres)

Quality filter

Nuveen investable farmland geographies
(83M acres)

OPINION PIECE. PLEASE SEE IMPORTANT DISCLOSURES IN THE ENDNOTES.

CONCLUSION

Approximating the institutionally investable universe of cropland requires the application of several filters. These filters underlie Nuveen's investment approach to global farmland and guide portfolio composition. Crop diversification within and across countries hospitable to foreign investment with export oriented agricultural economies is the thesis guiding the top down view of the market. Once target geographies and crops are identified, farmland level and local market factors require analysis to further refine the investable universe. This bottom up selectivity is apparent in Nuveen's current holdings and is the motivation for considering just 15% of total acreage in our investable universe methodology. A summary of our investable geographies, acreages and market values resulting from our methodology can be referenced below.

It is important to note that the investable universe is dynamic and new opportunities may arise. Countries may evolve and become more favorable for investment, global demand may strengthen the investment case for certain crops, or aging farmer demographics could bring new properties into the marketplace. Whatever the case may be, Nuveen continues to evaluate the global market for institutional grade farmland and apply the same analytical framework in this paper to guide our investment universe and build globally diversified portfolios.

Nuveen's investable farmland summary

Theoretically Investable Geographies	Gross Acres (millions)	Investable Geographies	Gross Acres (millions)	Investable Acres (millions)	Market Value Estimate (billion USD)
United States	212	United States	212	32	$420-500
Brazil	157	Brazil	157	24	$100-110
Australia	77	Australia	77	12	$30-40
France	47	Poland	28	4	$25-30
Spain	41	Romania	23	3	$5-10
Germany	29	*Peru*	12	2	$10-15
Poland	28	*Spain*	41	1	$10-20
Italy	23	*Italy*	23	1	$10-15
Romania	23	Denmark	6	1	$5-10
U.K.	15	Uruguay	5	1	$1-2
Peru	12	Portugal	4	1	$5-10
Greece	8	*Chile*	4	1	$5-6
Denmark	6	*New Zealand*	1	1	$5-10
Uruguay	5				
Portugal	4				
Chile	4				
Austria	3				
New Zealand	1				
Ireland	1				
Total	**697**		**593**	**83**	**$600-700 billion**

Permanent crops only

For more information, please visit our website, nuveen.com/naturalcapital

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