**Methods Used to Calculate the Index and Compile the Ranking of Abundance of Flora and Fauna**

In order to calculate **the index of abundance of flora and fauna**, allowing to determine the success rate of conservation of biodiversity, the level of agricultural development and food security in countries across the world and carry out international comparisons, the author’s evaluation technique has been developed, which involves the following sequence of actions (Figure 1).

Figure 1. Algorithm for calculating the index of abundance of flora and fauna

Source: prepared and compiled by the authors.

As is shown in Figure 1, **during Step 1,** indicators are brought to common units of measurement expressed in unit fractions (global mean value is taken as a unit). Depending on the qualitative interpretation of the initial indicator, one of the two corresponding calculation formulas is used for this purpose – (1) and (2).

Formula for indicators where higher is better:

aiv = iiv/amw, (1)

where aiv is the adjusted indicator value, unit fractions (higher is better);

iiv is the initial indicator value, initial units of measurement

amw is the arithmetic mean of initial values of the indicator for all countries of the world, initial units of measurement.

Formula for indicators where lower is better:

aiv = amw/iiv, (2)

In formula (2), all values of indicators above 2 are made equivalent to 2. The following logic is used for the calculation of presented indicators (Table 1).

Table 1. Calculation logic for adjusted indicators

|  |  |  |  |
| --- | --- | --- | --- |
| **Subject area** | **Initial (statistical) indicator** | **Qualitative interpretation of the initial indicator** | **Conventional designation of the adjusted indicator** |
| Biodiversity: conservation of terrestrial ecosystems | External threats to biodiversity | *lower* is better | BT |
| Deforestation | *lower* is better | PD |
| Index of survival of Red Book species | higher is better | RL |
| Average area of protected fresh-water lots that are important to conservation of biodiversity | higher is better | PF |
| Average area of protected terrestrial lots that are important to conservation of biodiversity | higher is better | PT |
| Biodiversity: conservation of marine ecosystems | Fish caught by trawling | *lower* is better | FT |
| Overexploited fish stocks | *lower* is better | FO |
| Ocean health index | *lower* is better | OH |
| Average area of protected sea areas that are important to conservation of biodiversity | higher is better | PM |
| Agriculture | Soil for corn farming | higher is better | LC |
| Rural population | higher is better | RP |
| Grain yield | higher is better | CY |
| Agriculture, forestry and fishery, added value | higher is better | AF |
| Food security | Food security indicator | higher is better | FS |
| Food affordability | higher is better | FA |
| Food accessibility | higher is better | FV |
| Food quality and safety | higher is better | FQ |

Source: prepared and compiled by the authors.

The results of bringing indicators to common units of measurement make it possible to automatically **monitor biodiversity, agriculture and food security** in countries across the world for the factor analysis, the study of cause and effect relationship of abundance of flora and fauna.

**During Step 2,** aggregated indicators are calculated for each designated subject area by formulas (3), (4).

The aggregated biodiversity indicator from the perspective of conservation of terrestrial ecosystems is calculated by the following formula:

Acte=(BT+PD+RL+PF+ PT)/5 (3)

The aggregated biodiversity indicator from the perspective of conservation of marine ecosystems is calculated by the following formula:

Acme=(FT+FO+OH+PM)/4 (4)

The aggregated indicator of agricultural development is calculated by the following formula:

Aagr=(LC+RP+CY+AF)/4 (5)

The aggregated indicator of food security is calculated by the following formula:

Afsc=(FS+FA+FV+FQ)/4 (6)

The higher are the values of all aggregated indicators, the better. **During Step 3**, the integrated indicator of abundance of flora and fauna is calculated by the following formula:

Iwapw=(Acte+Acme+Aagr+Afsc)/4 (7)

The higher is the value of the cumulative index of abundance of flora and fauna (Iwapw), the better and accordingly higher is the country’s position in the global **ranking of abundance of flora and fauna.**

Depending on the obtained values of aggregated indicators (Acte, Acme, Aagr, Afsc), **countries across the world have been grouped according to the criterion of abundance of flora and fauna**, and the following categories have been identified:

* Countries with abundant flora and fauna characterized by high biodiversity and food security;
* Countries with abundant biodiversity but food insecurity despite developed agriculture;
* Countries with abundant biodiversity but food insecurity due to underdeveloped agriculture;
* Countries with food security but lack of biodiversity;
* Countries with lack of biodiversity and food insecurity.

The developed scale for classification of countries across the world according to the criterion of abundance of flora and fauna is shown in Figure 2. The values of indicators are compared against world arithmetic means.

high

Level of agricultural development and food security

Biodiversity

high

low

low

Countries with abundant flora and fauna characterized by high biodiversity and food security:

* (Acte+Acme)/2>0.66
* Aagr>0.72
* Afsc>0.12

Countries with abundant biodiversity but food insecurity despite developed agriculture:

* (Acte+Acme)/2>0.66
* Aagr<0.72
* Afsc>0.12

Countries with abundant biodiversity but food insecurity due to underdeveloped agriculture:

* (Acte+Acme)/2>0.66
* Aagr<0.72
* Afsc<0.12

Countries with food security but lack of biodiversity:

* (Acte+Acme)/2<0.66
* Aagr>0.72
* Afsc>0.12

Countries with lack of biodiversity and food insecurity:

* (Acte+Acme)/2<0.66
* Aagr<0.72
* Afsc<0.12

Figure 2. Scale for classification of countries across the world according to the criterion of abundance of flora and fauna

Source: prepared and compiled by the authors.

As is shown in Figure 2, the following values of Iheg index have been determined and are used in author’s classification:

* If (Acte+Acme)/2>0.66, Aagr<0.72, Afsc<0.12, then the country falls under the category of countries with abundant biodiversity, but food insecurity due to underdeveloped agriculture;
* If (Acte+Acme)/2>0.66, Aagr<0.72, Afsc>0.12 then the country falls under the category of countries with abundant biodiversity, but food insecurity despite developed agriculture:
* If (Acte+Acme)/2>0.66, Aagr>0.72, Afsc>0.12 then the country falls under the category of countries with abundant flora and fauna, characterized by high biodiversity and food security;
* If (Acte+Acme)/2<0.66, Aagr>0.72, Afsc>0.12 then the country falls under the category of countries with food security, but lack of biodiversity;
* If (Acte+Acme)/2<0.66, Aagr<0.72, Afsc<0.12, then the country falls under the category of countries with lack of biodiversity and food insecurity.

Countries for which no sufficient statistical data are available for the calculation of aggregated indicators and the integrated indicator, fall under the category “rest of the world”.