**Descripción general del algoritmo**

Eight-year crop rotations were taken into account, ranging from 2010 to 2017, in which summer and winter crops were studied separately. As a first step, Córdoba’s polygon crop map was divided into pixels of 1 acre size, resulting in a total of 566409 pixels per map. This action was performed with ArcGIS Pro [] for each year and for each seasonal period, resulting in a total of 16 pixel-maps. Afterwards, the pixel’s crop information for all eight years was retrieved, and gathered into a sequence of eight crop identifiers. These sequences are called crop rotations, and summarize how a specific acre has been rotating its crop during the last eight years. The crop rotations were generated using the python API of ArcGIS []. Two crop rotations for each of the 566409 pixels (acres) were generated, one for the summer and another for the winter. For each seasonal period, crop rotations were classified in a set of prefixed categories (listed in table [1] and [2] respectively), resulting in two new maps, one for summer and another for winter. After this classification, these maps were crossed, resulting in a single map containing the pixel categories summarized in table [3].

During the sequence generation step, MZ and SRG were considered as the same type of crop and were given the same identifier. The same consideration was taken with SJ and MN (aca justificar por que decidieron hacer esto). Therefore, the 5 summer crops under consideration were (MZ or SG), (SJ or MN), RSV, OTV, and SC, and the 4 winter crops studied were RSI, TR, OTI, and SC.

**Descripción de cómo funciona el algoritmo en Python que nosotros escribimos.**

In the case of summer crop rotations, all pixels were classified into one of the defined categories listed in table 1. The algorithm that we have written works as follows. First of all, it checks that every pixel has less than three years which have missing data. If there are more than three years of missing data, those pixels are labeled as SC. Afterwards, it identifies those pixels in which the crop rotation contains the sequence SJ-SJ-MZ more than two times, and classifies it as “2 1”. Afterwards, it searches in the remaining pixels for those which have the sequence SJ-MZ more than three times, and classifies them as “1 1”. For all the remaining pixels, it counts the amount of RSV and SJ in each sequence. If the number of SJ is larger than 2 and the number of RSV is larger than 2, it labels those pixels as “SJRSV”. If the number of RSV is larger the half the length of the sequence, than it labels those pixels as RSV. Then, from the remaining pixels, it counts the amount of times that MZ appears in the sequence. If it appears more times than half the length of the sequence, then it classifies that pixel as MAIZ. The categories MS, MSR and MS5 correspond to those remaining sequences, which consist only of MZ and SJ, MZ and SJ with one year of RSV, and MZ and SJ with one year of OTV respectively. Finally, from the remaining pixels, those in which all of the available summer crops are present were classified as TODOS. The remaining pixels were classified as OTROS.

In the case of winter crop rotations, all pixels were classified into one of the defined categories listed in table 2. The algorithm that we have written works as follows. First of all, it checks that every pixel has less than three years which have missing data. If there are more than three years of missing data, those pixels are labeled as SC. Afterwards, it looks for all pixels which only contain RSI and label them as RSI. If there other type of crops, it counts the amount of RSI or TRI in the crop rotation. If the amount of RSI or TRI is larger than half the length of the crop sequence, than it labels them as >RSI or >TRI respectively. Of the remaining pixels, which still aren’t classified, it selects those that have all the different type of crops available in winter and classifies them as TODOS. Finally, all the remaining pixels are classified as OTROS.

Table 1: summer categories for classification.

|  |  |
| --- | --- |
| **category** | **Description** |
| Monocultivo | exclusively corn or soybean |
| 1 1 | Rotating between corn and soybean |
| 2 1 | Two years of soybean and one of corn |
| 3 1 | Three years of soybean and one of corn |
| 4 1 | Four years of soybean and one of corn |
| MAIZ | More than four years of MZ |
| MS | Never done OTV or RSV (always SJ and MZ) |
| MSR | MS but with only one year of RSV in the rotation |
| MS5 | MS but with only one year of OTV in the rotation |
| TODOS | All type of summer crops appear in the rotation |
| SJRSV | More than 2 years of SJ and more than 1 year of RSV |
| RSV | More than 4 years of RSV |
| OTROS | None of the above |
| SC | More than three missing values |

Table 2: Winter categories for classification.

|  |  |
| --- | --- |
| **Category** | **Description** |
| RSI | Exclusively RSI |
| >RSI | More than half of the sequence is RSI |
| >TRI | More than half of the sequence is TRI |
| >OTI | More than half of the sequence is OTI |
| SIN CLASIFICAR | More than three missing values. |
| OTROS | None of the above |

Table 3: Crossed pixel categories (Esto no lo hice yo, poner las que correpsondan)

|  |  |
| --- | --- |
| **Category** | **Description** |
|  |  |