Dataset of forest landowner survey to assess interest in supplying woody biomass in two Southeastern United States fuelsheds

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A B S T R A C T

This article presents data from a recent mail survey of forest landowners regarding their land ownership characteristics and motivations, past and future management activities, and owner perceptions of bioenergy and its impact on forests. The data presented in this article are related to the research article entitled 'Opportunities and Attitudes of Private Forest Landowners in Supplying Woody Biomass for Renewable Energy' [1]. The survey was conducted in the Atlantic Coastal Plain of the United States, where two primary ports exporting wood pellets to Europe are located. Specifically, the data include responses on forest characteristics, forest management activities, knowledge and interest in woody biomass for energy production, and sociodemographic variables. Additionally, landowner decisions for supplying wood for traditional forest products and biomass for energy were

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modeled. More than 2900 forest landowners were contacted, with 707 owners providing completed surveys.
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1. Data

Information was collected via a survey designed to assess the characteristics, attitudes, and past and future management of private forest landowners in fuelsheds surrounding two of the primary United States (US) ports that export wood pellets to the European Union (EU) [1]. The Norfolk-Newport News, Virginia, (NNV) port accounted for 30% of US wood pellet exports in 2016; the Savannah, Georgia, (SAV) port was responsible for 18% [2]. The survey population was defined as those forest owners who controlled at least 4 ha (10 acres) in a sourcing area or fuelshed, defined as all forestland within 75 miles of the port location. The data files included below include summary statistics for the survey (Table 1): landowner characteristics, management activities, attitudes and perceptions (Tables 2–8); and modeling results (Tables 9 and 10). The raw data file and metadata can be accessed through Mendeley Data (see link provided above).

2. Experimental design, materials, and methods

The data were collected by a mail survey of a sample of private forest landowners (PFLs) who own forested property in at least one of the two fuelsheds. A total of 6000 forest owner names who owned at least 4 ha (10 acres) of forest was provided by Infogroup (http://www.infogroup.com), which
### Table 1
Private forest owner mail survey response rates.

|                          | Total | NNV Fuelshed | SAV Fuelshed |
|--------------------------|-------|--------------|--------------|
| Initial Surveys Mailed   | 2972  | 1472         | 1500         |
| Undeliverable surveys    | 1     | 0            | 1            |
| No Forest Owned          | 52    | 24           | 28           |
| Deceased                 | 10    | 4            | 6            |
| Final Survey Population  | 2909  | 1444         | 1465         |
| Completed Surveys        | 707   | 313          | 394          |
| Final Response Rate      | 24.3% | 21.7%        | 26.9%        |

### Table 2
Number (and percent) of respondents according to importance placed on reasons for keeping the land in the forest versus converting to other use or selling.

| Reasons for maintaining forestland | Very Important | Important | Moderately Important | Of little Importance | Not important | Not applicable |
|-----------------------------------|----------------|----------|----------------------|----------------------|---------------|----------------|
| To enjoy beauty or scenery        | 304 (45.3)     | 185 (27.5) | 108 (16.1)           | 43 (6.41)            | 21 (3.13)     | 10 (1.4)       |
| To protect nature for biological diversity or wildlife habitat | 303 (45.1) | 201 (29.9) | 117 (17.4) | 27 (4.0) | 18 (2.6) | 5 (0.7) |
| For land investment               | 254 (37.5)     | 208 (30.7) | 124 (18.3)           | 59 (8.7)             | 19 (2.8)      | 13 (1.9)       |
| For privacy                       | 223 (33.9)     | 173 (26.3) | 102 (15.5)           | 71 (10.8)            | 55 (8.3)      | 33 (5.0)       |
| To pass land on to my children or other heirs | 285 (41.8) | 174 (25.5) | 106 (15.5) | 43 (6.3) | 44 (6.4) | 29 (4.2) |
| For tax benefits                  | 135 (20.3)     | 126 (18.9) | 135 (20.3)           | 143 (21.5)           | 86 (12.9)     | 39 (5.8)       |
| For firewood                      | 40 (6.0)       | 66 (9.9)   | 159 (24.0)           | 172 (25.9)           | 168 (25.3)    | 57 (8.6)       |
| For woody biomass for energy other than firewood | 28 (4.3) | 68 (10.5) | 127 (19.6) | 168 (25.9) | 181 (27.9) | 75 (11.5) |
| For timber products\(^a\)         | 277 (41.0)     | 173 (25.6) | 113 (16.7)           | 52 (7.7)             | 49 (7.2)      | 11 (1.6)       |
| For NTFP                          | 42 (6.3)       | 66 (9.9)   | 94 (14.2)            | 190 (28.7)           | 198 (29.9)    | 72 (10.8)      |
| For hunting or other recreational use\(^a\) | 203 (29.8) | 195 (28.6) | 132 (19.4) | 65 (9.5) | 60 (8.8) | 25 (3.6) |
| I have no other higher valued option for the land | 49 (8.9) | 72 (13.1) | 107 (16.1) | 75 (13.7) | 68 (12.4) | 175 (32.0) |

Note: Numbers in parentheses represent percentage of respondents.
\(^a\) Indicates significant difference between the two fuelsheds at 0.01 level (more important for owners in the Savannah fuelshed).

### Table 3
Percentage of respondents who reported management activities on their forests during past 5 years.

| Management activities                              | Overall | NNV | SAV |
|----------------------------------------------------|---------|-----|-----|
| Cut trees for sale for traditional wood production\(^a\) | 50.6    | 35.5| 62.5|
| Cut trees for firewood                            | 25.1    | 24.4| 25.6|
| Cut trees to clean up site\(^a\)                   | 29.6    | 24.8| 33.4|
| Remove brush\(^a\)                                | 37.9    | 30.9| 43.4|
| Collect NTFP\(^a\)                                | 14.9    | 11.4| 17.6|
| Road construction\(^a\)                           | 27.9    | 17.3| 36.2|
| Remove invasive plants\(^a\)                      | 23.6    | 14.7| 30.6|
| Improve wildlife habitat\(^a\)                     | 46.2    | 31.9| 57.4|
| Cut trees for woody biomass energy\(^a\)           | 5.4     | 2.3 | 7.9 |
| Forest insect control\(^a\)                        | 12.6    | 7.2 | 16.8|
| Tree disease control\(^a\)                        | 10.7    | 5.9 | 14.5|
| Controlled burning\(^a\)                          | 26.9    | 9.1 | 40.8|
| Hunting by third parties\(^a\)                     | 36.9    | 32.2| 40.6|
| Graze livestock                                    | 9.3     | 9.1 | 9.4 |

\(^a\) Indicates significant difference between the two fuelsheds at 0.01 level (more important for owners in the Savannah fuelshed).
Table 4
Percentage of respondents according to reported uses of thinned material.

| Thinned Material Use                  | Overall | NNV | SAV |
|---------------------------------------|---------|-----|-----|
| Burned on site                        | 2       | 2   | 3   |
| Left to rot                           | 10      | 11  | 10  |
| Used for firewood<sup>a</sup>         | 4       | 7   | 1   |
| Sold<sup>a</sup>                      | 51      | 37  | 62  |
| Not sold but removed from site        | 1       | 1   | 1   |
| Used for timber<sup>a</sup>           | 29      | 22  | 35  |
| Used for pulpwood<sup>a</sup>         | 45      | 31  | 57  |
| Used for bioenergy<sup>a</sup>        | 3       | 0   | 5   |

<sup>a</sup> Indicates significant difference between the two fuelsheds at 0.01 level (more prevalent in the Savannah fuelshed).

Table 5
Percentage of landowners reporting adoption of best management practices.

| Activity                            | Overall | NNV | SAV |
|-------------------------------------|---------|-----|-----|
| Forest road construction<sup>a</sup> | 24      | 14  | 31  |
| Timber Harvesting<sup>a</sup>       | 44      | 33  | 53  |
| Site preparation<sup>a</sup>        | 24      | 11  | 34  |
| Reforestation<sup>a</sup>           | 33      | 23  | 41  |
| Prescribed burning<sup>a</sup>      | 27      | 9   | 40  |
| Pesticides<sup>a</sup>              | 8       | 3   | 12  |
| Fertilization<sup>a</sup>           | 6       | 2   | 9   |
| Protection of race species or habitats<sup>a</sup> | 10      | 2   | 16  |
| Control of invasive plants or brush control<sup>a</sup> | 20      | 8   | 28  |

<sup>a</sup> Indicates significant difference between the two fuelsheds at 0.01 level (more prevalent in the Savannah fuelshed).

Table 6
Number (and percent) of respondents according to reported agreement with awareness of woody biomass for energy.

|                                                               | Strongly Agree | Somewhat Agree | Neutral | Somewhat Disagree | Strongly Disagree | Total |
|---------------------------------------------------------------|----------------|----------------|---------|-------------------|------------------|-------|
| Woody biomass-based energy is a viable alternative to fossil fuels<sup>a</sup> | 139 (24.3)     | 217 (37.9)     | 167 (29.0)| 35 (6.1)         | 14 (2.4)         | 572 (100) |
| The use of forest biomass for energy is limited to woody materials that lack other markets | 72 (12.7)      | 204 (36.1)     | 225 (39.89)| 41 (7.2)        | 22 (3.9)         | 564 (100) |
| The value of my forest is higher than it otherwise would have been because of the growing demand for wood pellets | 60 (10.6)      | 133 (23.0)     | 326 (57.6)| 26 (4.5)        | 21 (3.7)        | 566 (100) |
| I would be proud to supply wood that could serve as a long-term, renewable energy source<sup>a</sup> | 177 (31.1)     | 202 (35.5)     | 150 (26.4)| 20 (3.5)        | 19 (3.3)        | 568 (100) |
| Woody biomass-based energy has more environmental costs than benefits | 23 (4.1)       | 67 (11.9)      | 364 (65.1)| 62 (11.1)       | 43 (7.6)        | 559 (100) |

<sup>a</sup> Indicates significant difference between the two fuelsheds at 0.01 level (higher degree of agreement for owners in the Savannah fuelshed).
| Potential Bioenergy Effects                          | Large Increase | Some Increase | No Effect | Some Decrease | Large Decrease | Total  |
|-----------------------------------------------------|----------------|---------------|-----------|---------------|----------------|--------|
| Area of forests in plantations                      | 39 (7.5)       | 272 (52.4)    | 169 (32.5)| 27 (5.2)      | 12 (2.3)       | 519 (100) |
| Area of naturally regenerated forests               | 20 (3.9)       | 238 (46.9)    | 195 (38.4)| 37 (7.3)      | 17 (3.3)       | 507 (100) |
| Conservation of habitats that support rare species   | 23 (4.5)       | 172 (33.9)    | 185 (36.5)| 104 (20.5)    | 22 (4.3)       | 506 (100) |
| Abundance of game animals                           | 55 (10.5)      | 224 (42.8)    | 138 (26.3)| 91 (17.4)     | 15 (2.8)       | 523 (100) |
| Potential for wildfire                              | 42 (8.0)       | 162 (30.9)    | 145 (27.6)| 145 (27.6)    | 30 (5.7)       | 524 (100) |
| Soil erosion*                                        | 37 (7.1)       | 193 (37.1)    | 184 (35.3)| 87 (16.7)     | 19 (3.6)       | 520 (100) |
| Forest insect outbreaks                              | 10 (1.9)       | 142 (27.6)    | 213 (41.5)| 139 (27.1)    | 9 (1.7)        | 513 (100) |
| Tree diseases                                       | 10 (1.9)       | 142 (27.6)    | 213 (41.5)| 139 (27.1)    | 9 (1.7)        | 504 (100) |
| Use of Best Management Practices                    | 74 (14.5)      | 254 (50)      | 147 (28.9)| 29 (5.7)      | 4 (0.7)        | 508 (100) |
| Air quality                                         | 80 (15.4)      | 179 (34.5)    | 183 (35.3)| 63 (12.1)     | 13 (2.5)       | 518 (100) |
| Water quality                                       | 68 (13.1)      | 172 (33.2)    | 199 (38.4)| 66 (12.7)     | 12 (2.3)       | 517 (100) |
| Jobs                                                | 58 (11.3)      | 321 (62.5)    | 124 (24.1)| 4 (0.7)       | 6 (1.1)        | 513 (100) |
| Income for forest owners                            | 82 (15.7)      | 360 (68.9)    | 70 (13.4)| 7 (1.3)       | 3 (0.5)        | 522 (100) |
| Global warming                                      | 34 (6.5)       | 104 (20.1)    | 301 (58.2)| 64 (12.3)     | 14 (2.7)       | 517 (100) |
| Forest productivity                                 | 73 (14.3)      | 307 (60.3)    | 102 (20.0)| 24 (4.7)      | 3 (0.5)        | 509 (100) |
| Injuries related to forest harvesting                | 13 (2.5)       | 168 (33.2)    | 298 (59.0)| 22 (4.3)      | 4 (0.7)        | 505 (100) |
| Access to nutritious food                           | 17 (3.3)       | 90 (17.8)     | 367 (72.8)| 23 (4.5)      | 7 (1.3)        | 504 (100) |
| Fossil fuel use                                     | 16 (3.1)       | 105 (21.5)    | 191 (37.8)| 179 (35.4)    | 10 (1.9)       | 505 (100) |
| US energy security                                  | 25 (4.9)       | 249 (49.2)    | 217 (42.8)| 13 (2.5)      | 2 (0.4)        | 506 (100) |
| Regional economic growth                            | 35 (6.8)       | 309 (60.7)    | 157 (30.8)| 6 (1.1)       | 2 (0.3)        | 509 (100) |
| Family members retained in the region               | 29 (5.6)       | 141 (27.4)    | 327 (63.7)| 9 (1.7)       | 7 (1.3)        | 513 (100) |

**Indicates significant difference between the two fuelsheds at 0.01 level (perception that soil erosion is more likely to increase from owners in the Savannah fuelshed).
Table 8
Perception of the effects of market and policy factors on willingness to sell biomass by number and percent of respondents.

| Factor                                                                 | Very Unlikely | Somewhat Unlikely | Neutral | Somewhat Likely | Very Likely | Total |
|------------------------------------------------------------------------|---------------|-------------------|---------|-----------------|-------------|-------|
| Assurance of a long-term market for woody biomass for energy\(^a\)     | 12 (2.1)      | 6 (1.0)           | 76 (13.7) | 235 (42.6)      | 222 (40.2) | 551 (100) |
| Assurance that woody biomass for energy will increase our nation's energy independence | 12 (2.1)      | 12 (2.1)          | 121 (22.0) | 245 (44.5)      | 160 (29.0) | 550 (100) |
| Nearby markets\(^a\)                                                  | 11 (2.0)      | 7 (1.2)           | 102 (18.7) | 205 (37.7)      | 218 (40.1) | 543 (100) |
| Woody biomass price as high as pulpwood\(^a\)                         | 8 (1.4)       | 14 (2.5)          | 74 (13.5)  | 171 (31.2)      | 280 (51.1) | 547 (100) |
| Technical assistance to harvest woody biomass in a manner that improves stand productivity and future timber value | 9 (1.6)       | 7 (1.2)           | 67 (12.1)  | 217 (39.3)      | 252 (45.6) | 552 (100) |
| Evidence that harvesting woody biomass for energy improves species composition in naturally regenerating forest | 11 (2.0)      | 10 (1.8)          | 108 (19.8) | 236 (43.3)      | 180 (33.0) | 545 (100) |
| Certification of forestland is not required                           | 14 (2.6)      | 15 (2.8)          | 277 (52.2) | 133 (25.0)      | 91 (17.1)  | 530 (100) |
| Assurance of no interference with sawtimber production on my land\(^a\) | 9 (1.6)       | 13 (2.3)          | 123 (22.5) | 198 (36.3)      | 202 (37.0) | 545 (100) |
| Assurance of reduced fire and disease risk to the owner’s forest\(^a\) | 8 (1.4)       | 11 (2.0)          | 70 (12.7)  | 231 (42.1)      | 228 (41.6) | 548 (100) |
| Other neighbors harvesting biomass                                     | 18 (3.3)      | 21 (3.8)          | 201 (36.9) | 205 (37.6)      | 99 (18.2)  | 544 (100) |
| A landowner cooperative including neighbors that negotiates pellet price with buyers | 14 (2.5)      | 24 (4.3)          | 164 (29.8) | 240 (43.7)      | 107 (19.4) | 549 (100) |
| Assurance that forests in owner’s region will not be over-harvested    | 15 (2.7)      | 24 (4.3)          | 130 (23.5) | 235 (42.6)      | 147 (26.6) | 551 (100) |

\(^a\) Indicates significant difference between the two fuelsheds at 0.01 level (perception that factor is more unlikely to increase willingness to sell is greater for owners in the Savannah fuelshed.)
| Dependent Variables | Definitions | Mean  | Std. Dev. |
|---------------------|-------------|-------|-----------|
| FUTBIOENERGY        | Likelihood of cutting trees for sale for woody biomass for energy (Five-point Likert scale from “Very likely (5)” to “Very unlikely (1)”): 2.55 | 2.55  | 1.36      |
| FUTWOOD             | Likelihood of cutting trees for sale for woody biomass for traditional wood products (Five-point Likert scale from “Very likely (5)” to “Very unlikely (1)”): 3.89 | 3.89  | 1.45      |
| **Forestland Characteristics** | | | |
| NNV                 | Dummy variable: 1 if forest land is in NNV fuelshed, 0 if forest land is in SAV fuelshed | 0.43  | 0.5       |
| LAREA               | Natural log of forest area reported by landowner | 4.97  | 1.25      |
| DISTANCE            | Distance between permanent residence of respondent and forestland | 50.60 | 114.31    |
| YEAR                | Number of years forest area has been held by owner | 27.46 | 21.7      |
| **Management Characteristics** | | | |
| PLAN                | Dummy variable: 1 if a landowner has a written management plan, 0 otherwise | 0.49  | 0.5       |
| THIN                | Dummy variable: 1 if thinning is ever done, 0 otherwise | 0.66  | 0.47      |
| GFINANCE            | Dummy variable: 1 if increasing financial value of the land is important, 0 otherwise | 0.71  | 0.45      |
| WILDLIFE            | Dummy variable: 1 if keeping land in forest for biodiversity and wildlife is important, 0 otherwise | 0.72  | 0.45      |
| TIMBER              | Dummy variable: 1 if keeping forest land for timber production is important, 0 otherwise | 0.64  | 0.48      |
| HUNTING             | Dummy variable: 1 if hunting by third parties was done in the forestland in the past 5 years | 0.37  | 0.48      |
| **Bioenergy**       | | | |
| VIABLE              | Dummy variable: 1 if landowner believes wood-based energy is a viable alternative to fossil fuels, 0 otherwise | 0.52  | 0.50      |
| PELLET              | Dummy variable: 1 if landowner believes the growing demand for pellets puts higher demand on the forestland, 0 otherwise | 0.27  | 0.44      |
| **Socio-economics** | | | |
| AGE                 | Age of landowner | 68.53 | 11.40     |
| MALE                | Dummy variable: 1 if a landowner is male, 0 otherwise | 0.74  | 0.44      |
| INCOME              | Annual income of landowner in thousands of dollars | 103.29 | 60.31     |
| COLLEGE             | Dummy variable: 1 if a landowner has completed college or higher degree, 0 otherwise | 0.64  | 0.48      |

1For forest maintenance variables (BEAUTY, WILDLIFE, LAND, TIMBER), forest management goal (FINAN, NONFIN) variables, a value of “1” signifies that the respondent indicated that the factor was “very important” or “important”. If “0”, the respondent considered it “somewhat important”, “moderately important”, or “of little importance”. Similarly, for the variables COST and HIGHPELLET, “1” indicates the respondent marked “strongly agree” or “somewhat agree”; “0” indicates “strongly disagree” or “somewhat disagree”.

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randomly selected the names from the company's database. A survey population of 1500 in each fuelshed was randomly drawn from the 6000 names.

The survey was conducted following a modified Dillman approach [3]. The questionnaire was pre-tested with a small group of Tennessee PFLs. After minor modifications to the wording of three questions, a cover letter and revised questionnaire (see Supplemental Materials) were mailed to 2978 forest owners (1500 in the NNV fuelshed; 1478 in the SAV fuelshed). Surveys mailed to 28 PFLS in the SAV fuelshed were not delivered with the original mailing and subsequently were omitted from the survey population. Ten days later, a postcard was mailed to the entire survey population, encouraging them to complete the survey. Three weeks after the postcard reminder, a second letter and copy of the questionnaire was mailed to all who had not returned the original survey.

More than 700 completed surveys were received by the end of the survey cycle. Of the original 2972 PFLs in the survey population, 1 was eliminated due to a bad address, 52 because the individual no longer owned forested property in the fuelsheeds, and 10 due to death. This resulted in a revised population total of 2909 (Table 1). A total of 707 completed surveys were received, resulting in a final response rate of 24.3%. This response is on par with, or better than, response rates reported in recently conducted landowner surveys [4–7]. Table 1 also provides information regarding the 21.7 and 26.9% response rates for the two fuelsheds.

Tables 2–8 provide the descriptive and summary statistics of the survey, while Tables 9 and 10 pertain to landowner decision models. Table 2 depicts the relative importance of a series of reasons that may influence forest owners to maintain their land in forest. Table 3 provides the percentage of owners in both watersheds who conducted specific forest management activities during the past five years. Of those landowners who thinned their forest stands during the past five years, Table 4 lists the use for the thinned material. Table 5 shows the percentage of owners who adopted best management practices for a range of forest management practices. Tables 6–8 summarize the knowledge, attitudes, and perceptions of the respondents. Table 9 lists the variables used in the binary logit models of landowner harvest decisions in the two watersheds, as well as the mean and standard deviation of each

| Variable                  | Woody based bioenergy | Traditional wood products |
|----------------------------|-----------------------|---------------------------|
|                            | Coef. (Std. Err.) | Odds Ratio | Coef. (Std. Err.) | Odds Ratio |
| **Forestland characteristics** |                       |               |                   |
| NNV                       | 0.326 (0.29)        | 1.39        | –0.560* (0.30)  | 0.57       |
| LAREA                     | 0.242** (0.11)      | 1.27        | 0.469** (0.12)  | 1.60       |
| DISTANCE                  | 0.002** (0.001)     | 1.00        | 0.001 (0.001)   | 1.00       |
| YEAR                      | 0.008 (0.01)        | 1.01        | 0.015* (0.01)   | 1.02       |
| **Management characteristics** |                       |               |                   |
| PLAN                      | 0.254 (0.26)        | 1.29        | 0.825* **(0.27) | 2.28       |
| THINNING                  | 0.005 (0.31)        | 1.01        | 0.725** (0.30)  | 2.07       |
| GFINANCE                  | 0.448 (0.30)        | 1.57        | 0.380 (0.30)    | 1.46       |
| WILDLIFE                  | –0.056 (0.27)       | 0.95        | 0.109 (0.28)    | 1.12       |
| TIMBER                    | 0.260 (0.34)        | 1.30        | 0.339 (0.32)    | 1.40       |
| HUNTING                   | 0.252 (0.24)        | 1.29        | 0.694**(0.26)   | 2.00       |
| **Bioenergy**             |                       |               |                   |
| VIABLE                    | 0.698** (0.26)      | 2.01        | –0.022 (0.27)   | 0.98       |
| PELLET                    | 1.246** (0.27)      | 3.48        | 0.610** (0.29)  | 1.84       |
| **Socio-economics**       |                       |               |                   |
| AGE                       | –0.037** (0.01)     | 0.96        | –0.013 (0.01)   | 0.99       |
| MALE                      | 0.576** (0.29)      | 1.78        | 0.474 (0.29)    | 1.61       |
| INCOME                    | –0.002 (0.002)      | 1.00        | –0.003 (0.002)  | 1.00       |
| COLLEGE                   | –0.182 (0.27)       | 0.83        | –0.620* (0.28)  | 0.54       |
| N                         | 271                  | 296         |                   |            |
| Chi-square                | 81.8                 | 110.71      |                   |            |
| Log Likelihood            | –378.3               | –326.9      |                   |            |

Note: ** Significant at 5%, * Significant at 10%.
variable. Table 10 provides the models of cutting trees for traditional wood products and woody biomass for energy.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104674.

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